

AN EVALUATION OF THE EFFECTS OF SOCIAL INTERACTION ON PREFERENCE
AND RESPONSE ALLOCATION

By

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Abstract

Stimulus preference assessment (SPAs) have been successful for determining preferred stimuli and activities to be used as reinforcers (Hagopian, Long, & Rush, 2004). One variable that may influence the outcomes of SPAs is whether social interaction is provided during the stimulus access period of the SPA. Therefore, the purposes of the current study was to (a) compare the results of SPAs in which toys were provided alone (Solitary Assessment) versus one in which the same toys were paired with social interaction (Social Assessment) for a large number of preschool-age children (Study 1), (b) determine an overall preference hierarchy when toys alone and those same toys with social interaction were in the same SPA for the same children in Study 1 (Combined Assessment; Study 2), and (c) determine response allocation across toys alone and toys plus social interaction during a reinforcer assessment in an attempt to validate the results from Study 2 and determine the influence of social interaction on responding for a subset of participants in Study 2 (Study 3). Study 1 results showed that preference for toys was stable across assessments (Solitary and Social Assessments) for the majority of participants. Study 2 results showed toys plus social interaction displaced toys alone for most participants. Study 3 results showed more allocation in responding to toys plus social interaction or social interaction alone over toys alone, which validated the results of the preference hierarchies in Study 2 for most participants.

Keywords: stimulus preference assessment, social interaction, paired-stimulus preference assessment, reinforcer assessment

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An Evaluation of the Effects of Social Interaction on Preference and Response Allocation

Systematic stimulus preference assessments (SPAs) have been used to determine preferred stimuli and activities that can be used as reinforcers in teaching or intervention programs for individuals with (Tullis et al, 2011) and without (Cote, Thompson, Hanley, & McKerchar, 2007; Resetar & Noell, 2008) intellectual and developmental disabilities (IDD). Various SPAs have been used to determine preferred stimuli and activities (see Hagopian, Long, & Rush, 2004 and Piazza, Roane, & Karsten, 2011 for review of SPAs), and they generally involve presenting one or more stimuli to an individual and measuring some response of the individual (e.g., selection response or interaction with stimuli) as a method to determine preference. Stimuli that are chosen to use as reinforcers are typically those that are selected or interacted with most (or most preferred).

A common SPA method is the paired stimulus preference assessment (PSPA; Fisher et al., 1992). During a PSPA, two stimuli are presented to the individual during each trial, the individual selects one item, and he or she is given access to the selected item for a brief period of time. After this access period, two new stimuli are presented, and the individual is again given access to the selected item. This process is continued until all the items have been presented with every other item at least once. At the end of the PSPA, a preference hierarchy is determined by dividing the number of times each stimulus was selected by the number of times the stimulus was presented. PSPAs have been used to determine hierarchical preference for a variety of items including edibles (e.g., Ciccone, Graff, & Ahearn, 2015; Rosco, Iwata, and Kahng, 1999; Windsor, Piche, and Locke, 1994), leisure items (e.g., DeLeon, Frank, Gregory, & Allman, 2009; Zhou, Iwata, Goff, & Shore, 2001), activities (e.g., Piazza, Fisher, Hagopian, Bowman, and Toole, 1996), and sensory stimuli (e.g., Paclawskyj & Vollmer, 1995; Piazza et al., 1996).

Overall, the PSPA has been shown to have good predictive validity as it yields effective reinforcers (e.g., Fisher et al., 1992; Piazza et al., 1996). Additionally, in comparison to other SPA methods, PSPAs have been shown to have good test-retest reliability in that preferences, particularly for high preference items, are relatively stable over time (DeLeon & Iwata, 1996; Hanley, Iwata, & Roscoe, 2006; Windsor, Piche, & Locke, 1994).

Although previous research has suggested the utility of SPAs for determining reinforcers, there are numerous variables that may influence the outcomes of SPAs. One variable includes history effects (i.e., things that happen between assessments or prior to assessments) such as the time that elapses between assessments (Hanley, Iwata, Roscoe, 2006; Zhou, Iwata, Goff, & Shore, 2001) and motivating operations such as programmed periods of satiation and deprivation to particular stimuli (Gottschalk, Libby, & Graff, 2000; Vollmer & Iwata, 1991) that may result in shifts in preference. Another variable that can result in shifts in preference involves how the assessment is arranged (i.e., things that happen during the assessment), which includes various stimulus dimensions such as the magnitude of the stimulus (e.g., number of edibles) (Trosclair-Lasserre, Lerman, Call, Addison, & Kodak, 2008; Hoch, McComas, Johnson, Faranda, & Guenther, 2002) or duration of stimulus access (DeLeon, Iwata, Connors, & Wallace, 1999; Jones, Dozier, & Neidert, 2014; Steinhilber & Johnson, 2007) as well as the type or quality of stimuli in the assessment (Bojak & Carr, 1999; Ciccone et al., 2015; DeLeon, Iwata, & Roscoe, 1997; Ortega, Iwata, Nogales-Gonzalez, & Frades, 2012).

Several studies have shown the influence of duration of access on preference assessment outcomes (e.g., Jones et al., 2014; Steinhilber & Johnson, 2007). Steinhilber and Johnson (2007) evaluated the extent to which access duration (i.e., 15 s vs. 15 min) during SPAs affected preference hierarchies in two adolescents diagnosed with autism spectrum disorder. In Study 1,

they conducted two different multiple-stimulus-without-replacement (MSWOs; DeLeon & Iwata, 1996) SPAs. In one MSWO, leisure items were associated with 15-s access (short access) to the selected item; in the other MSWO, the same leisure items were associated with 15-min access (long access) to the selected item. Once the MSWOs were completed, ranked preference hierarchies were generated for each of the preference assessments. Results showed that some items were more preferred when available for the short-access period, whereas other items were more preferred when they were available for 15 min. In Study 2, the experimenters conducted reinforcer assessments to determine allocation of responding for high-preferred stimuli when they were delivered for preferred durations as well as non-preferred durations. That is, for each participant, the experimenters identified a high-preferred item from the short assessment (short, high-preferred item; SHP) and a high-preferred item from the long assessment (long, high-preferred item; LHP) for each participant. Next, using a concurrent-operant arrangement, they compared responding for these items using both a short (15 s) and long (15 min) access duration. Results showed that response allocation validated the outcome of the MSWOs. That is, both participants allocated more responding to the LHP item as compared to the SHP item when access time was long (15 min) for both stimuli. Additionally, one participant allocated more responding to the SHP when a short duration of access was provided for both stimuli. In a replication and extension of Steinhilber and Johnson, Jones et al. (2014) evaluated the extent to which access duration (i.e., 30 s vs. 5 min) during MSWOs affected preference hierarchies in 11 typically developing preschoolers. The experimenters conducted multiple MSWOs and evaluated both preference stability within and across assessments. Unlike the results for Steinhilber and Johnson, preferences were relatively stable across the two different assessments, particularly with respect to highly preferred items. However, in the evaluation of preference

rankings within assessments, rankings were more similar with 5-min access durations as compared to 30-s access durations. Although these results suggest 5-min access during SPAs might lead to determination of high preferred items that are more likely to function as reinforcers over time, the experimenters did not conduct reinforcer assessments to validate their preference assessment results. Overall, these two studies, as well as other basic (Catania, 1963; Neuringer, 1967) and applied (e.g., DeLeon et al., 1999; Hoch et al., 2002) studies suggest the potential importance of duration of stimulus access for influencing preference. Generally, practitioners should consider conducting preference assessment using access durations that are similar to those that will be used when the preferred items are used as reinforcers in habilitation and intervention programs.

Another stimulus dimension that may influence the outcomes of SPAs is the type or quality of stimuli included in the assessment (Bojak & Carr, 1999; Ciccone et al., 2015; DeLeon & Iwata, 1997; Ortega Iwata, Nogales-Gonzalez, & Frades, 2012). DeLeon, Iwata, and Roscoe (1997) evaluated whether including both edible and leisure items in an SPA would influence preference hierarchies for 14 individuals with IDD. Specifically, they wanted to know whether edible items would displace leisure items in SPAs. That is, whether leisure items would fall in rank as compared to the leisure-item only SPAs. First, the experimenters determined a hierarchy of leisure items and a hierarchy of edible items by conducting separate, multiple leisure- and edible-item MSWOs, respectively. The order of these separate assessments was counterbalanced across participants. Next, the experimenters conducted combined MSWOs with four of the highest preferred leisure items and three of the highest preferred edible items from the separate MSWOs for each participant. Finally, the experimenters conducted a single-operant reinforcer assessment with two of the participants to determine if a leisure item that was ranked lower than

the top three food items but ranked as the highest leisure item would function as a reinforcer. Results of the combined SPA showed that for (a) 12 of 14 participants (85.7%), the highest ranked item was an edible item, (b) for 11 of 14 participants (78.6%), the two highest ranked items were edibles, and (c) for 9 of 13 participants (69.2%), whose combined assessment included at least three edible items, the three highest ranked items were edibles. Thus, overall combined SPA results suggest that leisure items that were highly preferred in the separate leisure item SPA were displaced by highly preferred edible items in the combined assessment for the majority of participants. However, results of the reinforcer assessment showed that both participants engaged in increased levels of responding over baseline levels to access the high-preferred leisure item from the combined SPA even though it was less preferred than edibles for these two participants. Overall, the results of this study illustrate that one type of stimulus may displace another type of stimulus when both types of stimuli are combined in a preference assessment. Therefore, practitioners should conduct separate edible and leisure items preference assessments when determining preferred stimuli to use as reinforcers in teaching and intervention procedures.

Bojak and Carr (1999) replicated DeLeon et al. (1997) by evaluating whether edible items would be more preferred than leisure items when presented within the same MSWO preference assessment for four adults diagnosed with severe mental retardation. They also evaluated whether motivating operations (i.e., programmed periods of deprivation and satiation) would influence preference hierarchies of edibles and leisure items by conducting MSWO preference assessments before and after meals with these participants. In the first phase of the study, the experimenters conducted multiple MSWOs, which were all conducted between mealtimes to avoid any naturally occurring motivating operations during the first phase of the

study. First, they conducted separate edible and leisure item MSWOs to determine highly preferred items in each of these categories. Next, they conducted a combined assessment that included the top four edible items and leisure items from the separate MSWOs. Results of the combined MSWOs showed that for all four participants, the edibles were ranked highest (1st-4th) and leisure stimuli ranked lowest (5th-8th). During the second phase of the study, combined MSWOs for each participant were conducted immediately prior to and after evening meals for 5 consecutive days. Results for all participants showed that edibles continued to be more preferred than leisure items regardless of whether the SPAs were conducted before or after meals. Furthermore, none of the stimuli changed more than one rank across pre-meal and post-meal evaluations. These results replicate those of DeLeon et al. (1997) and suggest the robust preference for edibles regardless of programmed periods of deprivation and satiation from food.

In summary, previous research has shown that inclusion of edibles or certain types of edibles may influence preference hierarchies; however, it is unclear how other types of stimuli may influence preference. One such type of stimulus is whether social interaction is provided along with delivery of the item or activity during the access period in SPAs. Social interaction involves the delivery of attention including vocal-verbal interactions (e.g., praise, conversations), physical attention (e.g., hugs, high fives), and facial expressions (e.g., smiles, winks) and is ubiquitous in human interactions (Vollmer & Hackenberg, 2001). In fact, numerous studies have shown the efficacy of various forms of social interaction for increasing desirable behavior (e.g., LeBlanc, Hagopian, Marhefka, & Wilke, 2001; Kazdin, & Klock, 1973) as well as undesirable behavior (e.g., Kodak, Northup, & Kelley, 2007; Piazza et al., 1999; Fisher, Ninness, Piazza, & Owen-DeSchryver, 1996) in various populations across various contexts. Furthermore, previous research on preference for different types of social interaction (Kelly, Roscoe, Hanley, &

Schlichenmeyer, 2014; Piazza et al., 1999; Stephenson, & Hanley, 2010) suggest that social interaction is preferred and different types of social interaction may be more or less preferred than others. However, it is unknown how this variable may influence the outcomes of SPAs involving various items and activities.

In fact, it is unclear from the procedures sections of previous studies on SPAs whether social interaction is provided during SPA access periods; however, it is possible that this variable may influence the outcome of SPAs, which may influence the efficacy of particular stimuli as reinforcers in subsequent teaching or intervention programs. First, it is possible that experimenters and clinicians do not systematically program for the presence or absence of social interaction during SPAs such that when and how it is delivered across trials and assessments may influence the outcome of SPAs. For example, some stimuli may be presented with social interaction and others may be presented without social interaction. Thus, it is possible that the outcome of an SPA may result in the items that are presented with social interaction being more preferred or less preferred than those without social interaction. Second, it is possible that the provision of social interaction with the presentation of all stimuli could influence the outcome given that the addition of social interaction may increase or decrease preference for certain stimuli. For example, some items or activities (e.g., board games) may be more preferred when social interaction is provided (social items) and other items or activities (e.g., reading a book) may be more preferred when social interaction is not provided (solitary items).

The purpose of the current experiment was three-fold. The purpose of Study 1 was to compare the outcomes of a Solitary Assessment (PSPA with toys only) with a Social Assessment (PSPA with toys plus social interaction) for a large number of preschool children. The purpose of Study 2 was to conduct a Combined Assessment in which both solitary stimuli (toys only) and

social stimuli (toys plus social interaction) were included in the same PSPA to determine the degree to which the addition of social interaction influenced preference for toys in a large number of preschool children. The purpose of Study 3 was to conduct a concurrent-operants reinforcer assessment in an attempt to validate the results of the Combined Assessment, particularly with respect to the relative reinforcing efficacy of high-preferred solitary stimuli and social stimuli when they involved the same toys.

Study 1 Method: Solitary and Social Assessments

Participants, Setting, and Materials

Thirty-three typically developing children (21 males and 12 females) who ranged in age from 2.5-years-old to 6-years-old and attended a university-based preschool program participated. Participants were children who were reported by classroom supervisors to at least periodically engage in social interaction with peers and teachers. That is, children who were reported to be unusually shy or tended to play alone the majority of the time in the classroom were not included in this study. Additionally, participants were children who were reported to be able to remain seated without engaging in problem behavior that might interfere with completing the assessment for approximately 30 min. All sessions were conducted on a table or on the floor in session rooms that were adjacent to the preschool classrooms and contained a table, two chairs, and materials used during the course of the study.

During all SPAs, we included five different toys that were available during free play periods in the classroom. These toys included a remote control car, flipover car, Glodoodle®, Magnetix®, and pirate playset. In addition, during some assessments, pictures of the experimenter (.05 m x .08 m) were used to denote to the participant that social interaction would be provided with access to a particular toy.

Response Measurement, Data Analysis, and Interobserver Agreement

Trained observers recorded data using paper and pencil data collection. For both the Solitary Assessment (SPA with toys only) and the Social Assessment (SPA with toys plus social interaction), the dependent variable was stimulus selection, defined as the participant placing a hand on (or saying the name of) a presented stimulus within 5 s of stimulus presentation on a trial. We determined selection percentages for each stimulus in a preference assessment by summing the number of times a stimulus was selected and dividing that sum by the number of times that stimulus was presented. We used these selection percentages to determine stimulus rankings, which ranged from a rank of “1” (highest selection percentage) to “5” (lowest selection percentage). If selection percentages were the same for two stimuli, we reviewed the raw data to determine which of the two stimuli was selected on the trial in which they were both presented. The stimulus selected was assigned the higher rank. If selection percentages were the same for more than two stimuli, a similar procedure was used by which we reviewed the raw data to determine which stimulus was selected most often, second most often, etc. across trials in which the stimuli were presented with each other. The stimulus selected most was assigned the highest rank, the stimulus selected second most was assigned the second highest rank, and so on. If the stimuli were each selected once when presented with each other, then they were assigned the same rank. For example, if (a) Magnetix©, flipover car, and pirate playset were each selected on 75% of trials, and (b) on the trial in which Magnetix© was presented with flipover car, flipover car was selected, and (c) on the trial in which Magnetix© was presented with pirate playset, Magnetix© was selected, and (d) on the trial in which flipover car was presented with pirate playset, pirate playset was selected then (e) these results suggest that no stimulus was selected more than the other stimuli. Therefore, these stimuli would be assigned the same rank. Data

collectors also scored whether the experimenter delivered social interaction on each trial during preference assessments in which social interaction was programmed. Social interaction was defined as exuberant interaction provided by the experimenter that included a pleasant facial expression, enthusiastic tone of voice, positive statements and conversation about the child or the ongoing activity (e.g., statements about the toy or the child interacting with the toy).

In addition to stimulus rankings for each preference assessment, we also calculated the number of toys that were associated with shifts in preference across preference assessments (Solitary Assessment and Social Assessment). We defined a shift in preference for a toy across the two assessments (e.g., flipover car alone during the Solitary Assessment and flipover car plus social interaction during the Social Assessment) as a change in rank by two or more across assessments. For example, if the flipover car was ranked 4th in the Solitary Assessment and ranked 1st in the Social Assessment, this would be considered a shift in preference.

A second independent observer collected data on stimulus selections and social interaction delivery during approximately 47% of assessments across participants in Study 1. We calculated IOA for stimulus selection and social interaction by dividing the number of trials with agreement by the number of trials with agreement plus disagreement and multiplying by 100%. Mean IOA for stimulus selection was 98.7% (range, 90%-100%) across participants. Mean IOA for social interaction was 99.9% (range, 98%-100%) across participants.

Procedure

We conducted two separate PSPAs to determine stimulus rankings for common classroom toys when they were provided alone (Solitary Assessment) and with social interaction (Social Assessment) during the access period of the PSPA. That is, during the Solitary Assessment, all five toys were presented alone for a 30-s access period after they were selected.

During the Social Assessment, the same five toys were presented with social interaction (as defined above) during the 30-s access period after they were selected. The same experimenter conducted both PSPAs for a particular child. In addition, the Solitary Assessment was always conducted prior to the Social Assessment to decrease the likelihood of a previous programmed history of social interaction paired with toys influencing the outcomes of the Solitary Assessment. Furthermore, only one PSPA was conducted per day, but no more than 7 days elapsed between the two PSPAs to decrease the likelihood of changes in preference due to the period of time that had elapsed between PSPAs.

Solitary Assessment. The Solitary PSPA was conducted to determine preference for the five common toys when social interaction was not provided with any toys during access periods. Prior to this assessment, the experimenter provided pre-session access to each of the toys by presenting each toy to the participant, vocally labeling the toy, and providing 30-s access to the toy without social interaction. On each trial of the assessment, the experimenter placed two toys equidistant and in front of the participant, vocally labeled each toy, and prompted the participant to, “Pick your favorite.” Contingent upon toy selection, the experimenter provided 30-s access to the selected toy. No social interaction was delivered during the access period. After 30-s access to the selected toy, the experimenter removed the toy and presented the next two toys. This process was repeated until each toy had been presented with every other toy once for a total of 10 trials. If a participant did not select either toy within 5 s, the experimenter prompted the participant to interact with each toy for 5 s. After sampling each toy, the experimenter again presented the two toys to the participant. If the participant did not select either toy within 5 s, the experimenter removed both toys, scored “no choice” for that trial, and implemented the next trial.

Social Assessment. The Social PSPA was conducted to determine preference for the same five toys used in the Solitary Assessment but when both the selected toy and continuous social interaction was provided during the access period. Pre-session access was similar to the Solitary Assessment; however, the experimenter told the participant that she would play with the participant with each toy while she pointed to the picture of herself. For example, the experimenter would say, “This is the Glodoodle© (pointing to the Glodoodle©) with me (while pointing to the picture of the experimenter).” In addition, during the 30 s of pre-session access to each toy, the experimenter provided continuous social interaction. Trials were similar to those in the Solitary Assessment; however, when toys were presented on each trial, they were presented along with a picture of the experimenter, which would signal the availability of social interaction. That is, each toy was paired with a picture of the experimenter. Selection of a toy on each trial resulted in the experimenter delivering the selected toy plus social interaction for the 30-s access period. After 30-s access to the selected toy plus social interaction, the experimenter removed the toy plus social interaction and presented the next two toys with the pictures of the experimenter. This process was repeated until each social stimulus had been presented with every other social stimulus once for a total of 10 trials. If a participant did not select either social stimulus within 5 s, the experimenter prompted the participant to sample each social stimulus (toy plus social interaction) for 5 s. After sampling each stimulus, the experimenter again presented the two toys with corresponding pictures of the experimenter to the participant. If participant did not select either stimulus within 5 s, the experimenter removed both stimuli, scored a “no choice” for that trial, and began the next trial.

Study 1 Results: Solitary and Social Assessments

Figures 1-5 depict the results of the separate Solitary and Social Assessments for all participants. Figures 1 and 2 depict the results for the 13 (out of 33) participants whose top two toys were the same across the two assessments. Figure 1 depicts the results for the nine participants whose 1st and 2nd ranked toys were the same across assessments. For example, Estelle's 1st ranked toy was pirate playset and her 2nd ranked toy was Glodoodle© in both the Solitary and Social Assessment. Of these nine participants, three participants' (Estelle, Malia, and Reed) rankings were the exact same for all toys across assessments. For three others (Marcus, Andrew, and Lee), they only had a change in preference for one toy; however, this change in preference did not meet our definition for a shift in preference (i.e., there was only a shift of one ranking). For the remaining three participants (Taylor, McKenna, and Allie), there were some changes in preference, and one toy for each participant showed a shift in preference across assessments that met our definition. For example, the pirate playset was ranked 3rd in Taylor's Solitary Assessment but fell to a rank of 5th in the Social Assessment.

Figure 2 depicts the results for four other participants that displayed the same top two toys across assessments; however, for these participants, the 1st and 2nd ranked toys switched across assessments. For example, Lucas' 1st ranked toy was the Glodoodle© and 2nd ranked toy was the flipover car in the Solitary Assessment; however, in the Social Assessment, his 1st ranked toy was the flipover car and 2nd ranked toy was the Glodoodle©. With respect to shifts in preference, Lucas did not have any toys that changed preference that met our definition for a shift in preference across assessments. However, based on our definition, the three other participants (Alyssa, Blake, and Deliah) did show shifts in preference across assessments. Alyssa showed one shift in preference in that the pirate playset was ranked 3rd in the Solitary Assessment and ranked 5th in the Social Assessment. Blake showed two shifts in preference (one

for Magentix© and one for flipover car). Deliah also showed two shifts in preference (one for pirate playset and one for Magnetix©).

Figure 3 depicts results for 11 (of 33) participants whose top toy was the same across assessments. However, ranks for other toys changed across assessments. With respect to shifts in preference, five of these 11 participants (Jax, Avery, Hank, Callahan, and Nora) showed one shift in preference across assessments, four others (Blaine, Jaci, Nick, and Jordan) showed two shifts in preference across assessments, and two participants (Pierce and Ethan) showed three shifts in preference across assessments.

Figure 4 depicts results for seven (of 33) participants in which one of their top two toys stayed as a top two toy across both assessments. For example, the Glodoodle© was ranked 2nd in the Solitary Assessment and 1st in the Social Assessment for Fritz. With respect to shifts in preference across assessments, two participants (Fitz and Ivory) displayed one shift in preference, three participants (Candice, Adam, and Grace) displayed two shifts in preference, and two participants (Irvin and Gaby) displayed three shifts in toy preference across assessments.

Figure 5 depicts results for two (of 33) participants for whom toys, including high preference toys, were not ranked consistently across assessments. In fact, these data show little stability in preference across assessments. For example, Brock's 5th ranked toy in the Solitary Assessment (pirate playset) shifted to the 1st ranked toy in the Social Assessment, and Mady's 2nd ranked toy in the Solitary Assessment (remote control car) shifted to the 5th ranked toy in the Social Assessment. Overall, Brock showed two shifts in preference across assessments, and Mady showed three shifts in preference across assessments.

In addition to the above results, Table 1 depicts a summary of overall outcomes across the Solitary and Social Assessments in Study 1. With respect to similarities in preference

rankings across assessments for the top two ranked toys, results showed that 13 of the 33 participants' (39%) top two toys were the same across assessments, 20 of 33 participants' (61%) top ranked toy was the same across assessments, and 31 of 33 participants (94%) had at least one of the top two ranked toys the same across assessments. With respect to shifts in preference rankings based on a change in ranking by two or more ranks, 10 of 33 participants (30%) showed two toys with a shift in preference across assessments, 11 of 33 participants (33%) had one toy with a shift in preference across assessments, and 7 participants (21%) had zero toys with a shift in preference across assessments.

Study 2 Method: Combined Assessment

Participants, Setting, and Materials

The same 33 children who participated in Study 1 participated in Study 2. Experimenters conducted all sessions in the same session rooms as in Study 1. They also used the same five toys from Study 1 but with duplicates (i.e., two remote control cars, two flipover cars, two Glodoodles©, two Magnetix©, and two pirate playsets) such that the solitary stimulus (toy alone) and the social stimulus (toy plus social interaction) could be presented within the Combined Assessment. In addition, during some trials, pictures of the experimenter (.05 m x .08 m) were used to denote to the participant that social interaction would be provided with the toy if that stimulus was selected.

Response Measurement, Data Analysis, and Interobserver Agreement

Trained observers recorded data using paper and pencil data collection to collect data on stimulus selection and occurrence of social interaction delivery on each trial as defined in Study 1. In addition, a preference hierarchy was determined by calculating the percentage of trials in which each stimulus was chosen using the calculation in Study 1. As in Study 1, we also used

these percentages to determine rank order in preference from highest (1st) to lowest (10th).

However, if stimuli had the same selection percentages, rank was determined by reviewing the raw data as was done in Study 1.

A second observer collected data on approximately 60% of preference assessments in Study 2, and IOA calculations were the same as described in Study 1. Mean IOA for stimulus selection was 99.7% (range, 98%-100%) across participants. Mean IOA for social interaction delivery was 100% across participants.

Procedure

We conducted the Combined Assessment to determine preference for toys with (social stimuli) and without social interaction (solitary stimuli) in the same PSPA. Therefore, the same five toys in Study 1 and duplicates of those five toys paired with social interaction were the 10 stimuli included in the Combined Assessment. For example, there were two Glodoodles© such that one Glodoodle© could be presented alone (solitary stimulus) and the other Glodoodle© could be presented with social interaction (social stimulus) when that same toy was presented with a without social interaction on a particular trial. Procedures were similar to those in Study 1 with a few exceptions. Pre-session access involved presentation of the solitary and social stimuli using the procedures described in Study 1. On each trial in the Combined Assessment, the experimenter vocally labeled the two stimuli that were presented. That is, if one or both of the stimuli was a solitary stimulus, then the experimenter vocally labeled the toy as described in the Solitary Assessment of Study 1. However, if one or both of the stimuli was a social stimulus, then the experimenter presented the picture of the experimenter and the toy (see Appendices A for setup) and vocally labeled that stimulus similar to the way it was described in the Social Assessment of Study 1. For example, if the flipover car solitary stimulus and the remote control

car social stimulus were presented on a trial (see Appendices B for depiction), the experimenter would say, “This is the flipover car (pointing to the car) and this is the remote control car with me (while pointing to the picture of the experimenter). Pick your favorite.” Finally, based on which stimulus the participant selected, the 30-s access period was implemented as described in Study 1 for either solitary stimuli or social stimuli. That is, if the participant selected a solitary stimulus, the experimenter delivered the toy for 30 s. If the participant selected a social stimulus, the experimenter delivered the toy and continuous social interaction for 30 s. This process was repeated until each stimulus had been presented with every other stimulus once for a total of 45 trials. The same procedures as used in Study 1 were used if the participant did not make a choice on a particular trial.

Study 2 Results: Combined Assessment

Figures 6-14 depict the results of the Combined Assessment for all 33 participants. Figure 6 depicts results for the eight participants for whom all social stimuli (i.e., toys + social interaction [SI]) were more preferred than solitary stimuli (toys alone). That is, stimuli ranked 1st-5th were social stimuli and stimuli ranked 6th through 10th were solitary stimuli. For three of these participants (Adam, Estelle, and Marcus), their top ranked stimulus was the remote control car plus SI, which may suggest that something about this toy makes it more valuable when others interact with you. In addition, across these eight participants, some selected certain toys more when they were paired with social interaction as compared to when they were presented alone. For example, Magnetix© plus SI was ranked 2nd for Adam; however, he never selected the Magnetix© when it was presented alone. Similarly, Pierce’s highest ranked stimulus was the flipover car plus SI; however, the flip over car alone was his lowest ranked stimulus when presented alone. Finally, Brock’s second highest ranked stimulus was Magnetix© plus SI but

when Magnetix© was presented alone it was one of his lowest ranked stimuli. These data suggest that the combination of the toy plus social interaction may make some toys more preferred.

Figure 7 depicts results for the three participants for whom their top four ranked stimuli were social stimuli. In addition, there are some interesting additional results for these participants. For Alyssa and Blake, the two solitary stimuli (remote control car and Glodoodle©) that are ranked after the top four social stimuli, are the same toy as included in their top two social stimuli (remote control car + SI and Glodoodle©+ SI). In addition, for Andrew, one of the two solitary stimuli (Magnetix©) that is ranked after the top four social stimuli, is the same toy as included in his top ranked stimulus (Magnetix© + SI). This may suggest the high preference of these toys but also suggests that preference for these toys is higher when they are paired with social interaction. Another interesting finding for these participants is that the one social stimulus ranked lower than two solitary stimuli was also the lowest preferred solitary stimulus for all three participants. For Andrew, this toy was the remote control car; for Alyssa and Blake, this toy was the flipover car. Together, these data suggest that when presented alone, these toys were ranked last for all three participants suggesting that the toys themselves were not preferred, and although social interaction made them more preferred, they were still ranked relatively low.

Figures 8 and 9 depict results for the nine participants for whom their top three ranked stimuli were social stimuli. Figure 8 depicts results for five of these participants whose results also showed that the highest or two highest ranked solitary stimuli, which were ranked after the top three social stimuli, were the same toy or toys as the highest or two highest social stimuli. That is, for three (Taylor, Hank, and Grace) of the five participants, the solitary stimulus ranked 4th was the same toy as the highest ranked social stimulus (ranked 1st). For example, for Taylor,

Glodoodle© was ranked 4th and Glodoodle© plus SI was ranked 1st. For two (Mady and Lee) of the five participants, the solitary stimuli ranked 4th and 5th were the same toys as the top two highest ranked social stimuli (ranked 1st and 2nd). For example, for Mady, the flipover car and Magnetix© were ranked 4th and 5th and the flipover car plus SI and Magnetix© plus SI were ranked 1st and 2nd. Overall these data suggest that some toys are highly preferred but are more preferred when paired with social interaction. Finally, for all five of these participants, one or two of the lowest ranked solitary stimuli were the same toys as those in the lowest ranked social stimuli (that were also ranked below one or two solitary stimuli). For example, for Grace, (a) pirate playset and Magnetix© were ranked 9th and 10th and (b) Magnetix© plus SI and pirate playset plus SI stimuli were ranked 6th and 7th behind two solitary stimuli that were ranked 4th and 5th. These data suggest that some stimuli are low preferred even when social interaction is paired with those stimuli.

Figure 9 depicts results for four of the nine participants for whom their top three ranked stimuli were social stimuli. For three (Irvin, Gaby, and Malia) of these four participants, their highest preferred solitary stimulus (ranked 4th after the top three social stimuli) was the same toy as one of their top three social stimuli. For example, for Gaby, her highest preferred solitary stimulus was Magnetix©, which was ranked 4th (after three social stimuli), and Magnetix© plus SI was ranked 2nd (one of the top three social stimuli).

Figure 10 depicts results for four participants for whom their top two ranked stimuli were social stimuli. For three of these participants (Candice, McKenna, and Lucas), their top ranked solitary stimulus (ranked 3rd after the top two social stimuli) was the same toy as in one of the top two ranked social stimuli. For example, Magnetix© is ranked 3rd (after the top two toys plus SI stimuli) and Magnetix© plus SI is ranked 1st for Candice. Overall, these data suggest that

some toys alone may be more preferred than toys plus SI; however, even high preferred toys are somewhat more preferred when they are paired with social interaction.

Figure 11 depicts results for three participants for whom their top ranked stimulus was a social stimulus. In addition, for these participants, their second highest ranked stimulus was the solitary stimulus was the toy that was included in their top ranked social stimulus. For example, for Avery, Glodoodle© plus SI was ranked 1st and Glodoodle© was ranked 2nd. These data suggest that the toy was high preferred but it was more preferred with social interaction. Furthermore, similar patterns of responding were found for other rankings with some of these participants. For example, for Avery, her 3rd and 4th ranked stimuli were Magnetix© plus SI and Magnetix©, respectively.

Figure 12 depicts results for four participants for whom their top ranked stimulus was a solitary stimulus. For two participants (Jax and Jordan), their 2nd ranked stimulus was the same toy as a social stimulus. For example, Jax's 1st ranked stimulus was the remote control car and his 2nd ranked stimulus was the remote control car plus SI. These data suggest that certain toys may be high preferred but they are more preferred when they are presented alone. For the other two participants (Reed and Ivory), rankings were similar across the solitary stimuli and social stimuli. For example, for Reed, flipover car plus SI and flipover car were ranked 2nd and 3rd, respectively; Glodoodle© and Glodoodle© plus SI were ranked 5th and 6th, respectively; pirate playset and pirate playset plus SI were ranked 7th and 8th, respectively; and Magnetix© and Magnetix© plus SI were ranked 9th and 10th, respectively. These data show similar preferences for particular toys regardless of whether social interaction is presented with them; however, it also suggests that a slight change in preference may occur with and without social interaction.

Figure 13 depicts results for two participants for whom their top two ranked stimuli were solitary stimuli. For example, Nikki's top ranked stimulus was the Glodoodle© and 2nd ranked stimulus was the flipover car. Nick's top ranked stimulus was the remote control car and 2nd ranked stimulus was the Magnetix©. In addition, both participants lowest ranked stimulus was a social stimulus. For example, Nikki's lowest ranked stimulus was the pirate playset plus SI. Interestingly, Nick's three lowest ranked stimuli were all social stimuli. Thus, for these participants, it may be that some stimuli or most stimuli are more preferred when presented alone.

In addition to the above results, Table 2 depicts a summary of overall outcomes of the Combined Assessment. The data show that 27 of 33 participants (82%) had a social stimulus as their highest ranked stimulus, 24 of 33 participants (73%) had social stimuli as their top two highest ranked stimuli, 8 of 33 participants (24%) had all social stimuli ranked higher than solitary stimuli, 11 of 33 participants (33%) had at least four social stimuli ranked higher than solitary stimuli, 20 of 33 participants (61%) had at least three social stimuli ranked higher than solitary stimuli, and 5 of 33 participants (15%) had the solitary and social version of the same toys as their top two ranked stimuli.

Study 3 Method: Reinforcer Assessment

Participants, Setting, and Materials

Sixteen typically developing children (8 males and 8 females) who participated in Studies 1 and 2 participated in Study 3. In addition, participants who showed a particular pattern of responding in the Combined Assessment of Study 2 were selected to participate in Study 3. That is, participant results of Study 2 must have shown that either (a) three or more social stimuli were ranked higher than all toys alone stimuli or (b) the same toy with (social stimulus) and without

(solitary stimulus) social interaction was similarly high preferred (e.g., 1st and 2nd ranked stimuli). When (a) was demonstrated in the Combined Assessment, the toy designated as the high preferred (HP) stimulus (and used in Study 3) was the toy with the highest rank among the solitary stimuli *and* social stimuli. That is, the toy that when presented alone or with social interaction was ranked in the top two or three among both toys alone and toys plus SI. If there was more than one toy that met this requirement, the toy that had the closest ranking across solitary stimuli and social stimuli was chosen. When (b) was demonstrated in the Combined Assessment, the stimulus designated as the HP stimulus in Study 3 was the toy with and without social interaction that had similarly high selection percentages (i.e., the social and solitary version of that toy). The toy designated as the low preferred (LP) stimulus (and used in Study 3) was the toy with the lowest rank among the solitary stimuli *and* social stimuli. That is, the toy that when presented alone or with social interaction was ranked in the bottom two or three among both toys alone and toys plus SI. If there was more than one toy that met this requirement, the toy that had the closest ranking across solitary stimuli and social stimuli was chosen.

All sessions were conducted in the same session rooms as in Study 2 and were conducted two to four times per day, 3 to 5 days per week. At least one hour elapsed between all sessions. Additionally, the same experimenter who conducted the assessments in the two previous studies with a particular participant, continued to conduct the sessions in Study 3. Task materials included a laminated board, in which there were six equal squares (0.06 m by 0.06 m) containing black and white pictures of animals (i.e., duck, cat, bird, dog, cow, and horse) and a pile of small laminated squares (0.06 m by 0.06 m) each containing one of these same pictures for which the participants matched the small pictures to the corresponding picture on the board. See

appendices C for a depiction of the laminated board. An alternative task was also available during sessions, which included a common classroom item such as crayons and paper, a book, or a puzzle. Finally, pictures of the experimenter (.05 m x .08 m) were used to denote to that social interaction was available for responding toward a particular task.

Response Measurement, Data Analysis, and Interobserver Agreement

Trained observers recorded data using iPod data collection devices. The dependent variable was the rate of correct picture matches, defined as the participant placing a matching stimulus (i.e., picture of animal) on the correct sample stimulus on the laminated board and removing their hand. Rate of responding was calculated for each session by dividing the frequency of correct matching by the session duration minus reinforcer access time. That is, the duration of reinforcer access throughout the session was timed and removed from the total session time before the session rate was calculated. For example, if the total duration of all reinforcer access (i.e., HP solitary-stimulus access, SI access, HP social-stimulus access) was 300 s for a session then that amount of time was subtracted from the total session time for calculating rate of responding for that particular session. Data collectors also collected data on the rate of incorrect picture matches, defined as the participant placing a matching stimulus on the incorrect sample stimulus (i.e., picture of cow on horse exemplar) and removing their hand. We calculated rate in the same way as for correct picture matches. Finally, data collectors scored the duration of stimulus access and social interaction. Stimulus access was scored for the duration of time from which the experimenter presented the toy to the participant (stimulus access ON) until the experimenter removed the toy (stimulus access OFF). Similarly, social interaction was scored for the duration of time from which the experimenter began interacting with the participant (social interaction ON) until the experimenter no longer provided interaction

for 3 s (social interaction OFF). Social interaction was defined in the same way as it was in Studies 1 and 2.

A second observer collected data on approximately 48% of sessions across participants. To determine IOA for correct and incorrect picture matching, each 10-min session was partitioned into 10-s intervals, and we calculated IOA using the proportional agreement method. That is, the smaller number of responses in each interval was divided by the larger number of responses, averaged across intervals, divided by the total number of intervals, and multiplied by 100%. To determine IOA for stimulus and social interaction delivery, each 10-min session was partitioned into 10-s intervals, and the partial-interval agreement method of IOA was calculated. That is, the number of intervals with agreements, divided by the total number of intervals, and multiplied by 100%. Mean IOA for correct responses was 98.2% (range, 79%-100%) across participants. Mean IOA for incorrect responses was 99.7% (range, 92%-100%) across participants. Mean IOA for delivery of stimuli and social interaction was 98.9% (90%-100%) across participants.

General Procedure

All sessions were 10 min in duration and were conducted using a concurrent-operants arrangement. Phases included baseline, high preference (HP) evaluation, and low preference (LP) evaluation (if applicable). If we conducted the LP evaluation with a particular participant, we also used a reversal design for experimental control. Prior to all sessions, the experimenter prompted the child to sit in the chair or on the floor facing the task materials. Next, the experimenter provided pre-session exposure to each task, response requirement, and associated contingencies in place during each session. For example, during the conditions in which there were three identical tasks that were associated with three different contingencies, the

experimenter provided pre-session exposure to each task, response requirement, and contingency. The experimenter used three-step prompting, as necessary, to prompt the participant to engage in the required number of responses. Next, the experimenter reminded the participants (a) of the consequences associated with each response option, (b) that they can switch tasks at any time, and (c) that the experimenter cannot talk to them unless they access the experimenter's picture card during the session. As mentioned above, the task included matching different black and white animal cards to the corresponding black and white animal on the laminated matching board. The response requirement to access 30 s of the programmed reinforcer for correct responding on a particular task was a fixed-ratio (FR) 6 schedule of reinforcement (i.e., fills the laminated card associated with the stimulus) for 12 participants and an FR 1 schedule of reinforcement (i.e., one laminated picture is placed on laminated card associated with the stimulus) for four participants across all phases. Initially, we used an FR1 schedule of reinforcement in the study; however, for several participants for which we conducted probes, their rate of responding was very high under this requirement. Therefore, after the first four participants, we changed the requirement to an FR6. If during a session, the participant engaged in an incorrect response, the experimenter removed the incorrectly matched card to provide the opportunity for maximum correct responding on the laminated board. Additionally, once a laminated board was filled with all six correct responses the experimenter emptied the board to allow for additional correct responding. Finally, although participants were told that the experimenter could not talk to them, if they asked the experimenter a question, she would briefly answer the participant with a neutral affect.

Baseline. During baseline, only one set of task materials was presented to the participant. In addition, an alternative activity was available (e.g., paper and crayons, books,

puzzle). If the participant correctly or incorrectly matched during these sessions, the experimenter provided no programmed consequences. If the participant engaged in the alternative activity, the experimenter provided no programmed consequences.

HP evaluation. The purpose of the HP evaluation was to compare response allocation across three concurrently available response options (HP solitary stimulus [toy alone], HP social stimulus [toy + SI], and SI alone). During these sessions, three sets of identical task materials and an alternative activity were arranged in a quasi-random order in front of the participant. One set of task materials was associated with the delivery of the HP solitary stimulus. Thus, the HP toy was placed behind the task materials to denote to the participant the availability of that stimulus. Each time the participant reached their programmed response requirement of correct responding (i.e., FR 1 or FR 6) on this particular task, the experimenter provided 30-s access to the HP toy. After 30 s elapsed, the experimenter removed the toy. A second set of task materials was associated with the delivery of the social stimulus (HP toy + SI). Thus, the HP toy and the picture of the experimenter were placed behind the task materials to denote to the participant the availability of the toy and social interaction. Each time the participant met the FR 1 or FR 6 requirement of correct responding on this task, the experimenter provided 30-s access to the HP toy plus social interaction. After the 30 s elapsed, the experimenter removed the toy and social interaction. A third set of task materials was associated with the delivery of social interaction (SI) alone. Thus, only the picture of the experimenter was placed behind the task materials. Each time the participant met the FR 1 or FR 6 requirement on this task, the experimenter provided 30 s of social interaction only. After the 30 s elapsed, the experimenter removed social interaction. This SI stimulus was included in an attempt to determine whether responding occurred to access SI or if the combination of the toy plus SI was necessary.

LP evaluation. The purpose of the LP evaluation was to attempt to determine why some participants allocated more responding toward the HP social stimulus than the HP solitary stimulus or SI alone. That is, we attempted to tease apart whether this pattern of responding was due to a higher magnitude of reinforcement (as compared to the toy alone or SI alone) or the combination resulting in a qualitatively different stimulus (i.e., the toys became qualitatively different when the interaction was provided). Thus, only participants that showed this pattern of responding (i.e., higher responding for the HP social stimulus) were included in the LP evaluation. However, not all participants that showed this pattern of responding were included. The LP evaluation was identical to the HP evaluation; however, the solitary and social stimuli used in the evaluation included an LP toy from the Combined Assessment in Study 2.

Study 3 Results: Reinforcer Assessment

Figures 14, 15, and 16 display the results for all participants in Study 3. Figure 14 depicts the results for five participants that were included in Study 3 because the majority of social stimuli were higher ranked than solitary stimuli in the Combined Assessment of Study 2. The graphs in the left column depict results for Deliah and Estelle who showed similar outcomes. During baseline, these participants displayed zero to low rates of correct responding. During the reinforcement phase (S^R [HP]), both participants allocated high and similar levels of responding to the social stimulus (toy + SI) and social interaction (SI) only as compared to both baseline levels and the solitary stimulus (toy alone). These data suggest that it may be the delivery of SI that is the reinforcing aspect of stimulus delivery and not necessarily the combination of the toy with SI. The graphs in the right column depict results for Blake, Grace, and Malia, who showed similar outcomes. During baseline, these participants also displayed low rates of responding; however, during the reinforcement phase, all three participants responded at higher and more

stable levels for the SI stimulus as compared to the baseline, the solitary stimulus, and the social stimulus. These data suggest that the higher preference for social stimuli in the Combined Assessment is likely due to the delivery of social interaction. Furthermore, these data suggest that the inclusion of the toy with SI may decrease the relative reinforcing efficacy of SI.

Figure 15 depicts the results for nine participants that were also included in Study 3 because the majority of social stimuli were higher ranked than solitary stimuli in the Combined Assessment. During baseline (not conducted with Hank), all participants showed low or decreasing rates of responding. During S^R (HP), all nine participants allocated more responding to the social stimulus (HP toy + SI) as compared to baseline (for eight participants in which it was conducted), the solitary stimulus (HP toy alone), and SI alone. In addition, for two participants (Adam and Marcus), we also conducted the LP evaluation (S^R [LP]). Results were similar to the HP phase with Marcus in that rates of responding were highest for the social stimulus as compared to the solitary stimulus and SI alone. For Adam, during the first LP phase, results were also similar to the HP phase in that higher rates of responding occurred for the social stimulus as compared to the solitary stimulus and SI. However, these results were not replicated in the second S^R (LP) phase. Overall, the data for these participants suggest that the combination of the toy plus social interaction is what made the social stimuli preferred and not simply the SI, given that low levels of responding occurred for SI alone for these participants.

Figure 16 depicts the results for the two participants that were included in Study 3 because the same toy with (social stimulus) and without (solitary stimulus) social interaction was similarly high preferred in the Combined Assessment. Jordan displayed zero rates of correct responding in baseline. In both S^R (HP) phases, Jordan allocated more responding to the social stimulus as compared to the solitary stimulus and SI alone; these effects were replicated in a

subsequent phase. In the first S^R (LP) phase, Jordan displayed low rates of correct responding across response options; however, in the second S^R (LP) phase, he displayed similar patterns of responding as in the S^R (HP) phases. That is, he allocated more responding to the social stimulus as compared to solitary stimulus and SI alone. Jax displayed zero to low rates of correct responding in baseline. In the initial S^R (HP) phase, Jax allocated responding to all three stimuli similarly. For experimental control, we reversed to baseline and replicated zero to low rates of correct responding. Following baseline, we reversed to S^R (HP) and replicated the same pattern of correct responding in which Jax allocated responding similarly to all three stimuli.

Discussion

The purpose of Study 1 was to compare preferences for toys with (social stimuli) and without (solitary stimuli) social interaction separately. Overall results showed that 31 of 33 (94%) participants had at least one toy ranked in the top two across both Solitary and Social Assessments. Furthermore, 20 of 33 (61%) and 13 of 33 (39%) participants had the same toy or the same top two toys, respectively ranked the same across Solitary and Social Assessments. Thus, preferences for the highest preferred toys across assessments was relatively stable. Given that clinicians typically use the highest preferred (often the top one or two) stimuli from preference assessments to use in intervention programs, results for these participants suggest that regardless of whether social interaction was provided with toy access in the preference assessment, the same items would be chosen to use for treatment. Another major result of Study 1 is that 18 of 33 (55%) of participants showed one or no toys shift in rank across assessments. These data suggest the relatively stability of preference across all toys across the two assessments.

The purpose of Study 2 was to compare preference for solitary stimuli and social stimuli within a single PSPA (Combined Assessment). That is, one PSPA was conducted which included toys presented alone and toys presented with social interaction. Overall results showed that 61% of participants had at least four social stimuli that were ranked higher than solitary stimuli. Furthermore, with respect to top preferred stimuli, 82% of participants had a social stimulus as their highest preferred stimulus and 73% had social stimuli ranked as their top two preferred stimuli. Based on these results, the majority of participants preferred social stimuli over solitary stimuli. Thus, these data suggest that solitary stimuli and social stimuli are qualitatively different and result in different preferences. More specifically, the inclusion of social interaction with toys influences the preference for most toys. Thus, practical implications are that if one is to conduct a preference assessment with toys or other leisure items or activities, they should control for the delivery of social interaction. That is, they should either deliver social interaction with all stimuli or with no stimuli. Furthermore, in deciding this, they should consider how these stimuli might be delivered in their treatment or educational programs. For example, if stimuli will likely be delivered in a solitary manner, then they should be presented that way in the preference assessment. The data in Study 2 also suggest the degree to which providing social interaction with toys may enhance their value. Thus, when attempting to determine stimuli that may have robust effects on treatment and educational programs for young children, practitioners and teachers should consider the delivery of social interaction with those stimuli.

Study 2 represents a similar approach as DeLeon, Iwata, and Roscoe (1997) in which preference for edible and toys within the same assessment were compared in participants. Both studies look into different qualitative stimuli being used in one assessment. The current study

displayed similar results in that a qualitatively different stimulus influences the results of PSPAs. The majority of the participants in the current study, preferred toys paired with social interaction as compared to toys presented alone. These results suggest that conducting preference assessments with different qualitative stimuli, such as toys and attention, might yield a different hierarchy of preferred toys, that is, result in false negatives. Therefore, individuals should consider arranging the preference assessment similar to the context in which reinforcement will be provided. That is, these data suggest that SI should be provided during the preference assessment if SI will be provided with the reinforcer and that no SI should be provided during the preference assessment if no SI will be provided with the reinforcer. For example, if an experimenter needs to record data while the individual plays with the reinforcer (no SI will be provided), therefore, SI should not be included in the PA.

The purpose of Study 3 was to validate the outcomes of the results of the Combined Assessment by conducting reinforcer assessments. Specifically, we wanted to determine if similar allocation of responding for toys with and without social interaction would occur when the participant was required to engage in a pre-academic task. Furthermore, we included a SI only stimulus in an attempt to determine if it was the combination of the toy and SI that increased the value of the toy, or if it was simply social interaction. The purpose of the HP evaluation was to compare response allocation across the three concurrently available response options. Overall results of this assessment showed that 10 of the 16 participants allocated more correct responding toward the task associated with the toy plus SI, three participants allocated more and similar levels of correct responding to the tasks associated with SI and the toy plus SI, two participants allocated more correct responding to the task associated with SI only, and one participant allocated correct responding to all tasks (i.e., to access SI, toy alone, and toy plus SI).

These results suggest that, regardless of the toy, the majority of the participants preferred social interaction (either alone or paired with toy), which validates the outcomes of majority of the Combined Assessments in Study 2. That is, 27 of 33 participants in Study 2 had a social stimulus as their highest ranked stimulus.

Additionally, an LP evaluation was conducted with three participants to attempt to determine why some participants allocated more responding toward the toy plus SI than the toy alone or SI alone. That is, we attempted to tease apart whether this pattern of responding was due to a higher magnitude of reinforcement or the combination (toy and SI) resulting in a qualitatively different stimulus. Results of the LP analysis suggest that response allocation to the toy plus SI occurs because the two stimuli become qualitatively different when combined. During this analysis, two of the three participants responded toward the LP stimulus plus SI which suggests that response allocation was sensitive to the magnitude of reinforcement being delivered. That is, a toy whether HP or LP plus SI is better than any stimulus in isolation. If responding occurred toward SI alone, it would suggest that response allocation was sensitive to the availability of social interaction. However, one of the three participants showed zero responding during the second LP phase, which suggests that response allocation was sensitive to the combination of a HP stimulus and SI, not just because social interaction was provided.

Although we found interesting results in the current studies, there are some limitations within and across studies. One possible limitation across studies is that the type and variability of social interaction was not controlled within and across participants and assessments. Experimenters were told to provide exuberant interaction with the child which included a pleasant facial expression, enthusiastic tone of voice, positive statements, and conversation with the child regarding the child, the child's activity including their play with the toy, and applicable

toy play with the stimuli. However, they were not provided scripts or instructions regarding the type and number of different social interactions used within or across sessions. Thus, it is possible that the type and variability in social interaction may have influenced responding. For example, some experimenters might have had conversations in some sessions or with some participants that were more preferred than others, which may have influenced responding within and across participants. However, results suggest that both within and across participants, social interaction seemed to influence preference and response allocation even when it was not controlled within and across participants. Regardless, future researchers might evaluate the influence of various aspects of social interaction that result in social stimuli (toys plus social interaction) or social stimuli alone more preferred.

Another possible limitation is the degree to which the experimenters were familiar to participants. That is, for some participants, the experimenters were familiar in that they were their classroom teachers, whereas for others participants, the experimenters were unfamiliar or less known individuals. It is possible that this familiarity or the degree to which social interaction from the experimenter or the type of social interaction that was manipulated in session was available throughout the day might have influenced the effects of social interaction on responding. Thus, future researchers should consider evaluating the degree to which children have access to social interaction by a particular individual or the type of interaction delivered by a particular individual influences the effects of social interaction with respect to preference and reinforcing efficacy of that social interaction in general, specific types of interaction, or toys with social interaction.

Another possible limitation of Study 1 and Study 2 is the analyses we used to determine the effects. First, although we compared the ranks across assessments in Study 1 and the ranks

within the assessment in Study 2, similar to DeLeon et al. (1997), we could have compared the selection percentages in each of the assessments in Study 1 and the outcomes in Study 2 to determine the degree to which selection percentages changed across the assessments with respect to each category of stimuli (Solitary and Social). This might have given us a better idea of how much solitary stimuli were displaced by social stimuli in the Combined Assessment. Second, although we used visual analyses and summary statistics to describe the results of these studies, we did not use correlational or statistical analyses to determine the degree to which preferences were stable between the two assessments in Study 1 and each of the assessments in Study 1 and the results of the Combined Assessment in Study 2. Conducting these type of analyses would provide further support for our assertions regarding the stability of preferences and the degree to which preferences changed within and across assessment. For example, similar to DeLeon et al. (1997) and Jones et al. (2014), we will be using Kendall rank-order correlation coefficients between overall ranks for items across assessments in Study 1 (Solitary and Social Assessments with the same toys) and across the each of the assessment in Study 1 (Solitary and Social Assessment) and the Combined Assessment in Study 2.

Although we were able to validate the outcomes of the Combined Assessment in Study 2 with the concurrent-operants reinforcer assessment in Study 3 by determining the relative reinforcing efficacy of social and solitary stimuli that involved the same HP or LP toy, as well as SI alone, we were not able to determine the absolute reinforcing efficacy of these stimuli. If we had used a single-operant evaluation in which the reinforcing efficacy of each stimulus was evaluated alone, we would be able to determine whether each of the stimuli functioned as reinforcers. This would allow us to determine whether the stimuli that were ranked low in the Combined Assessment, particularly solitary stimuli, would function as reinforcers. If so, this

would provide additional support for ensuring that stimuli that are included in an SPA are or are not paired with social interaction to ensure that the correct stimuli are chosen for teaching and treatment programs. Future researchers should replicate the current study and use a single-operant arrangement to answer this question.

There are several additional areas for future research. Participants included in the current experiment were children who were observed to engage in SI with peers or teachers. However, it would be interesting to determine whether children who are reported to be shy or did not engage in high levels of social interaction with peers and teachers would show similar patterns of responding. In fact, future researchers might consider comparing the degree to which children engage in social interaction in the classroom (potentially by having teachers use a Likert Scale to rank their degree of social interaction) and the degree to which solitary and social stimuli function as preferred stimuli and reinforcers. Furthermore, for children for which social interaction or toys that involve social interaction is less preferred, various procedures could be evaluated to increase the reinforcing efficacy of social interaction. Finally, in the current study, common classroom toys were used as stimuli. It would be interesting to determine whether items that have historically been viewed as solitary stimuli (e.g., books or computer games) versus social stimuli (e.g., board games) would be more or less preferred when they are paired with various types of social interaction.

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Tables

Table 1. Solitary and Social Assessments

	Number of participants	Percent of sample
Top two toys same rank	13	39%
Top toy same rank	20	61%
One of top two toys same rank	31	94%
Two toys with shift in rank	10	30%
One toy with shift in rank	11	33%
Zero toys with shift in rank	7	21%

Table 2. Combined Assessments

	Number of participants	Percent of sample
Social stimulus ranked #1	27	82%
Social stimuli ranked #1 and #2	24	73%
5/5 social stimuli ranked higher than solitary stimuli	8	24%
4/5 social stimuli ranked higher than solitary stimuli	11	33%
3/5 social ranked higher than solitary	20	61%
Solitary stimulus and social stimulus with same toy ranked #1 and #2	5	15%

Figures

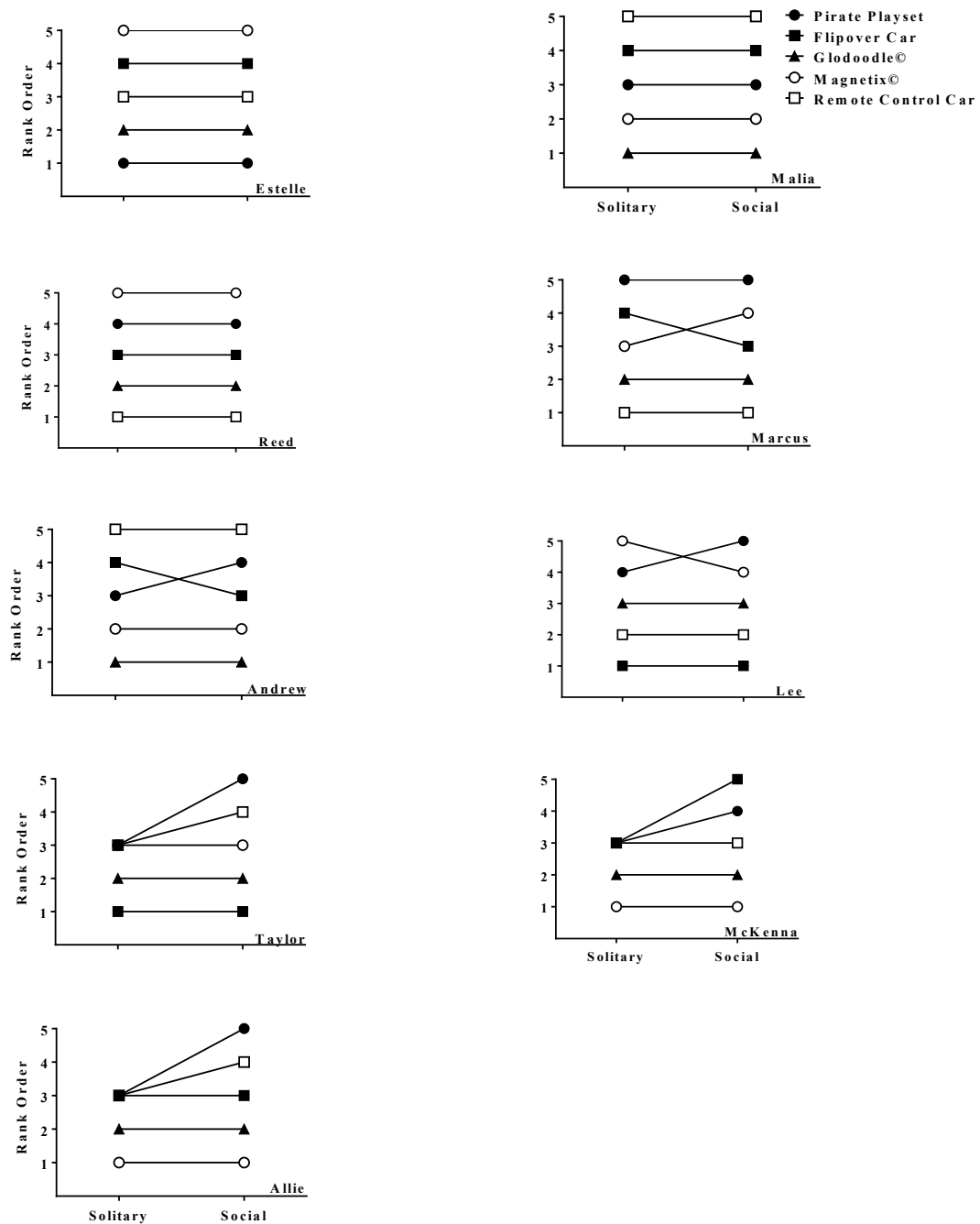


Figure 1. This figure depicts stimulus rankings of toys in the Solitary and Social Assessments in Study 1 for the nine participants (Estelle, Malia, Reed, Marcus, Andrew, Lee, Taylor, McKenna, and Allie) whose 1st and 2nd ranked item was the exact same across assessments.

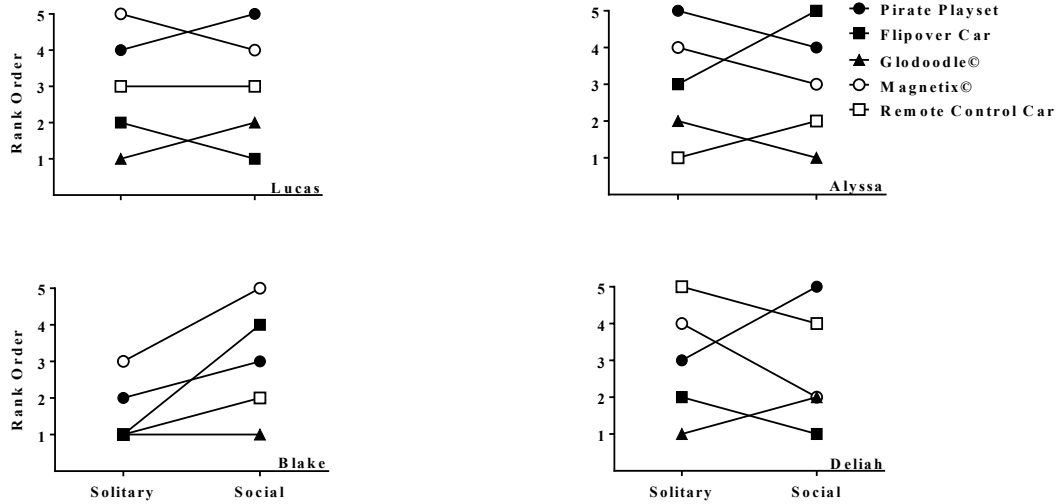


Figure 2. This figure depicts stimulus rankings of toys in the Solitary and Social Assessments in Study 1 for the four participants (Lucas, Alyssa, Blake, and Deliah) whose top two ranked items stayed in the top two across assessments.

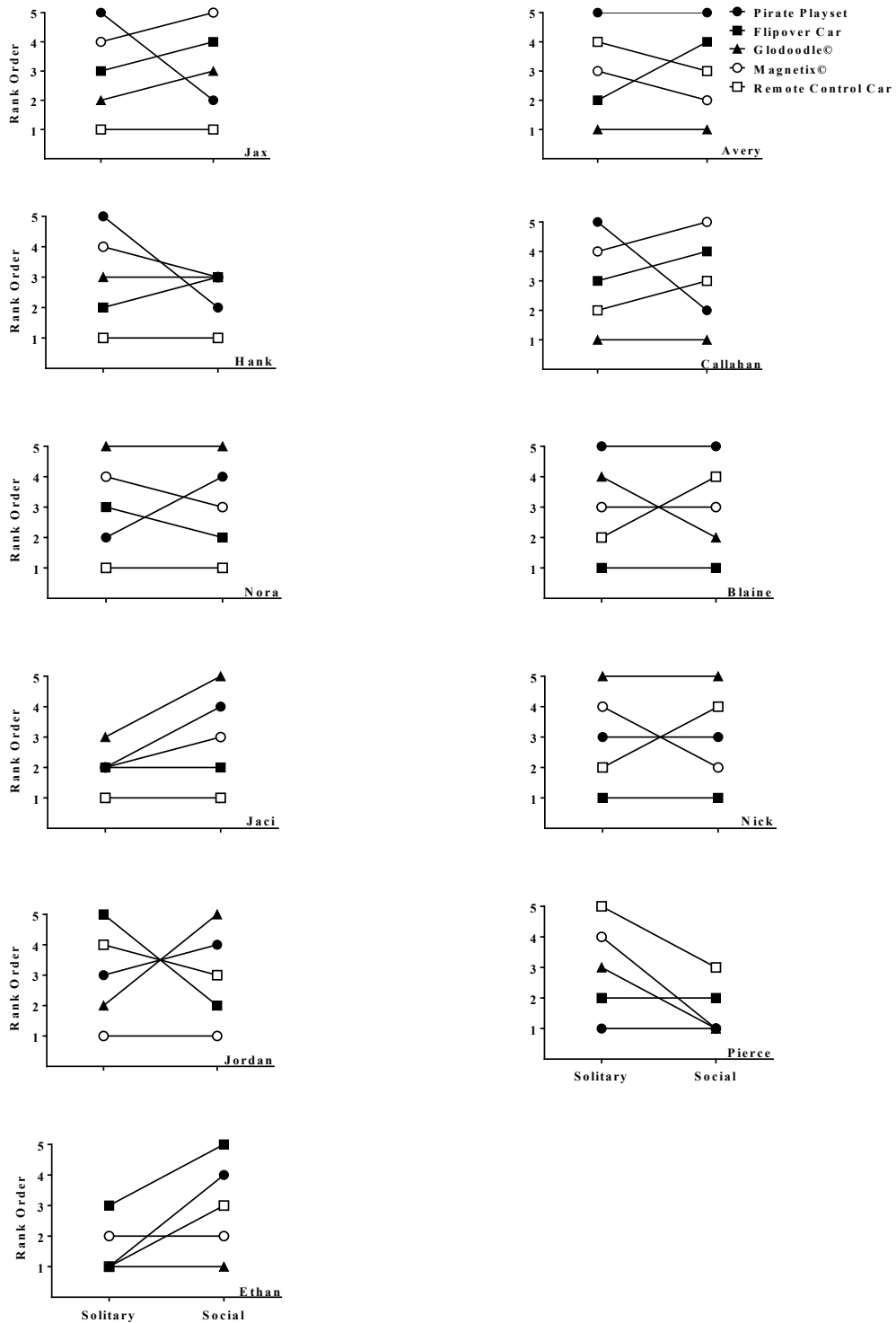


Figure 3. This figure depicts stimulus rankings of toys in the Solitary and Social Assessments in Study 1 for the 11 participants (Jax, Avery, Hank, Callahan, Nora, Blaine, Jaci, Nick, Jordan, Pierce, and Ethan) whose top ranked item stayed the same across assessments.

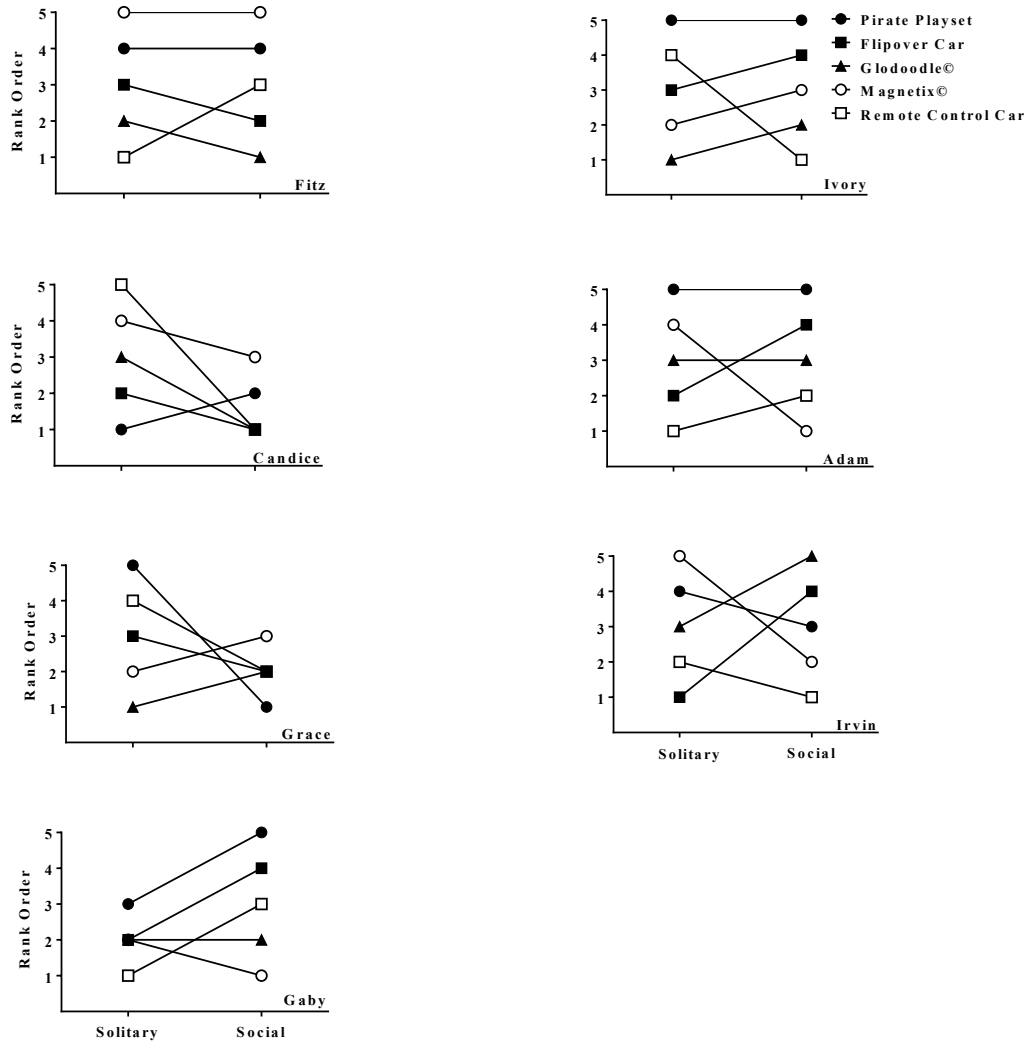


Figure 4. This figure depicts stimulus rankings of toys in the Solitary and Social Assessments in Study 1 for the seven participants (Fitz, Ivory, Candice, Adam, Grace, Irvin, and Gaby) whose top two toys had one item stay as a top two toy across assessments.



Figure 5. This figure depicts stimulus rankings of toys in the Solitary and Social Assessments in Study 1 for the two participants (Brock and Mady) whose rankings were not consistent across assessments.

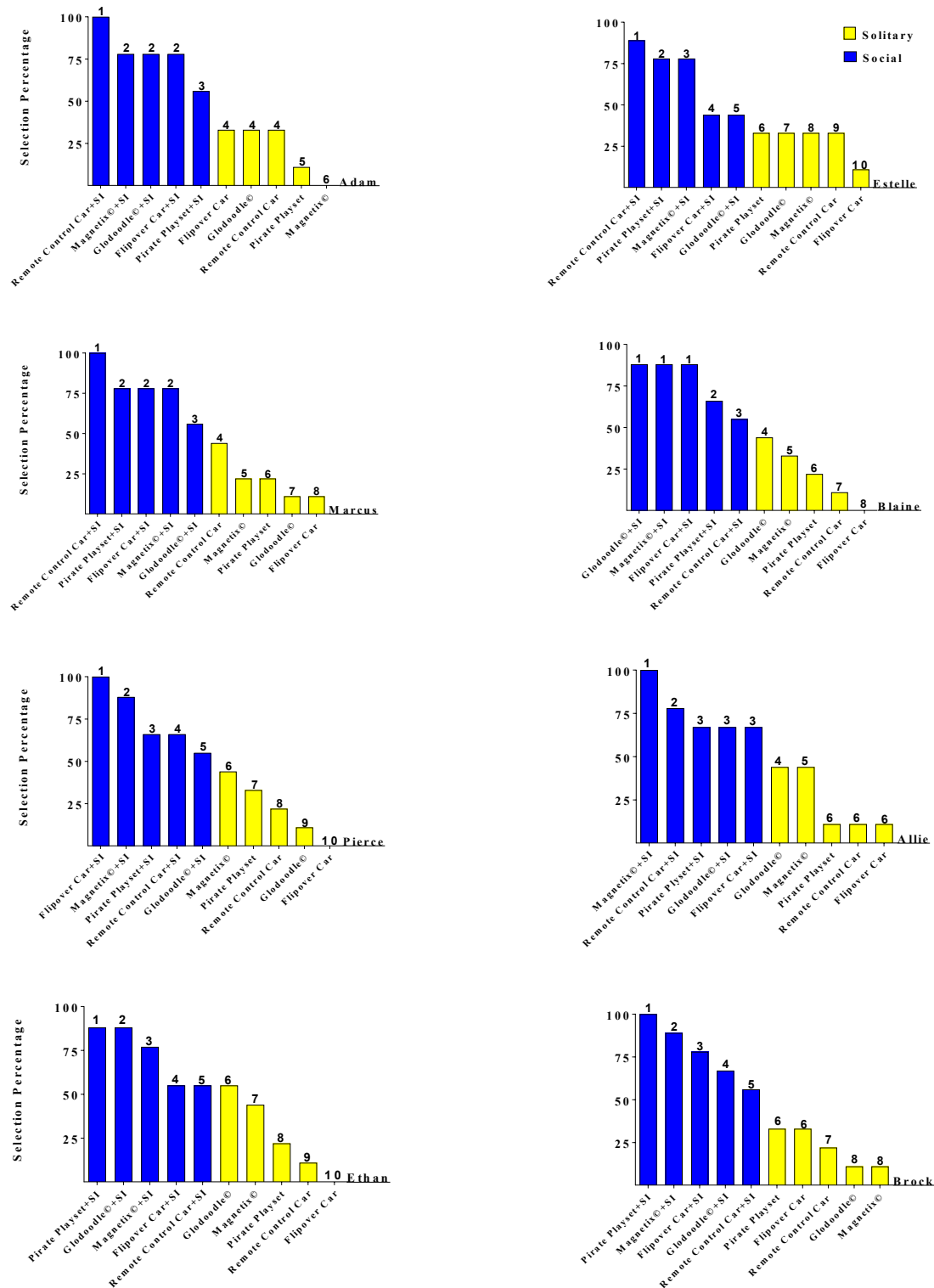


Figure 6. This figure depicts the Combined Assessment results for the eight participants (Adam, Estelle, Marcus, Blaine, Pierce, Allie, Ethan, and Brock) for whom all social stimuli (toys + social interaction [SI]) were more preferred than solitary (toys alone) stimuli. The numbers above each bar denote the calculated ranking of the stimulus.

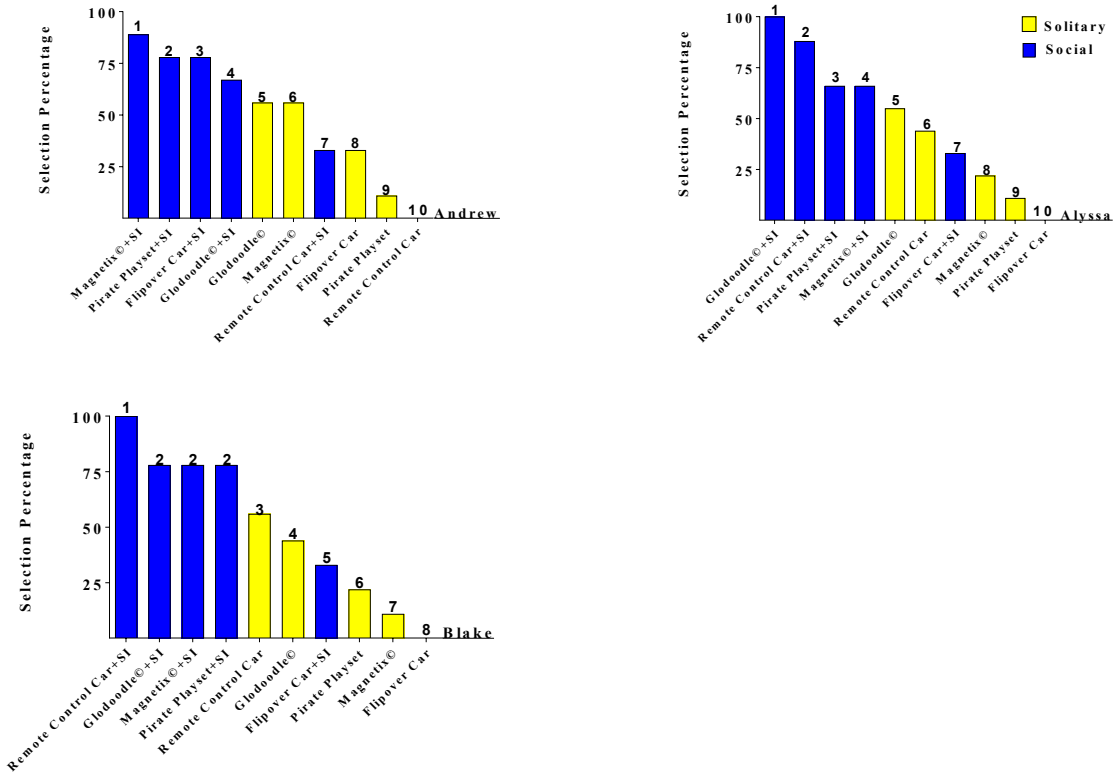


Figure 7. This figure depicts the Combined Assessment results for three participants (Andrew, Alyssa, and Blake) for whom four social stimuli were more preferred than all solitary stimuli. The numbers above each bar denote the calculated ranking of the stimulus.

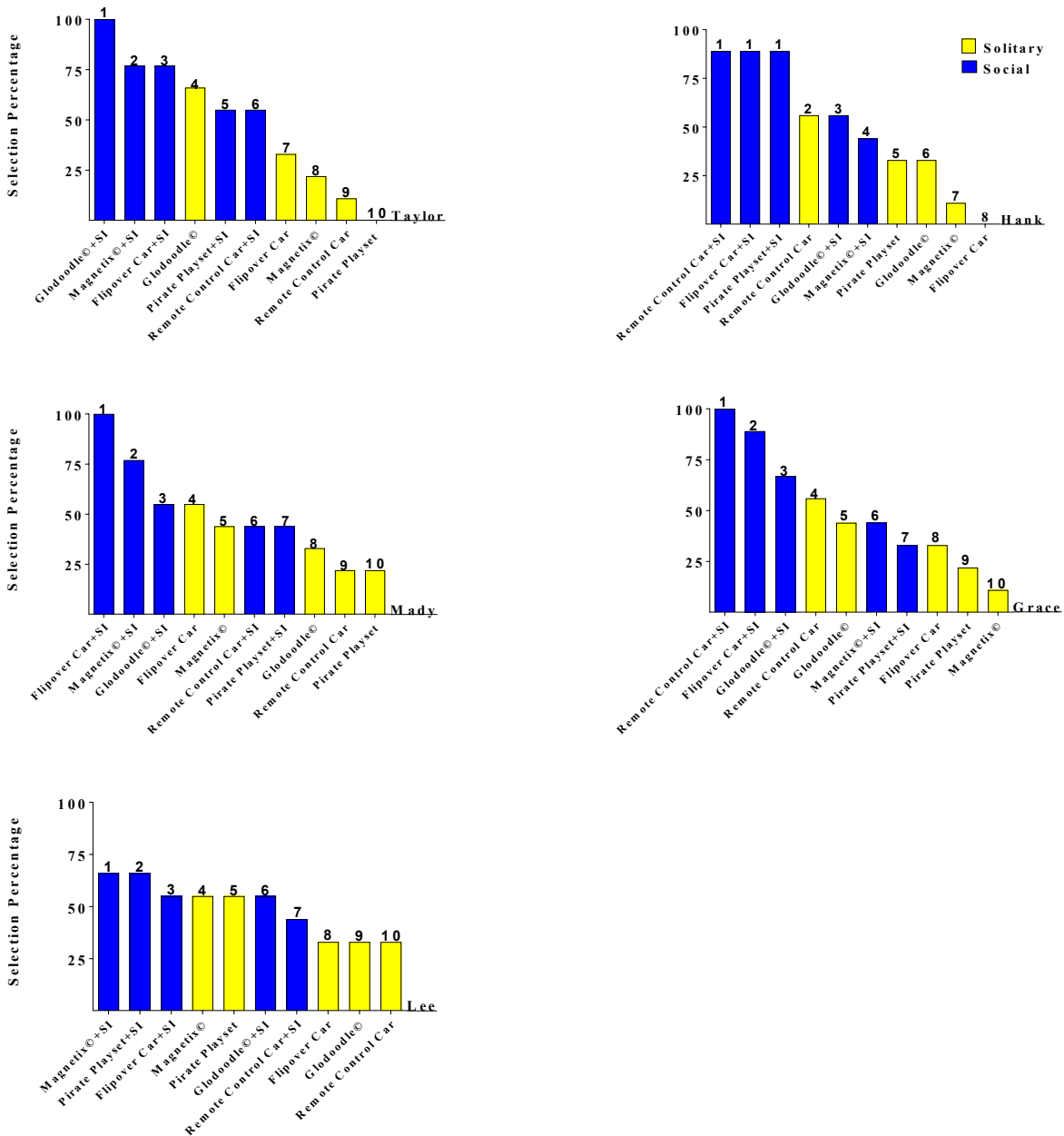


Figure 8. This figure depicts the Combined Assessment results for five participants (Taylor, Hank, Mady, Grace, and Lee) for whom three social stimuli were ranked higher than all solitary stimuli. In addition, for these participants, the 4th ranked stimulus was a solitary stimulus that was the same toy as in the top preferred social stimulus. The numbers above each bar denote the calculated ranking of the stimulus.

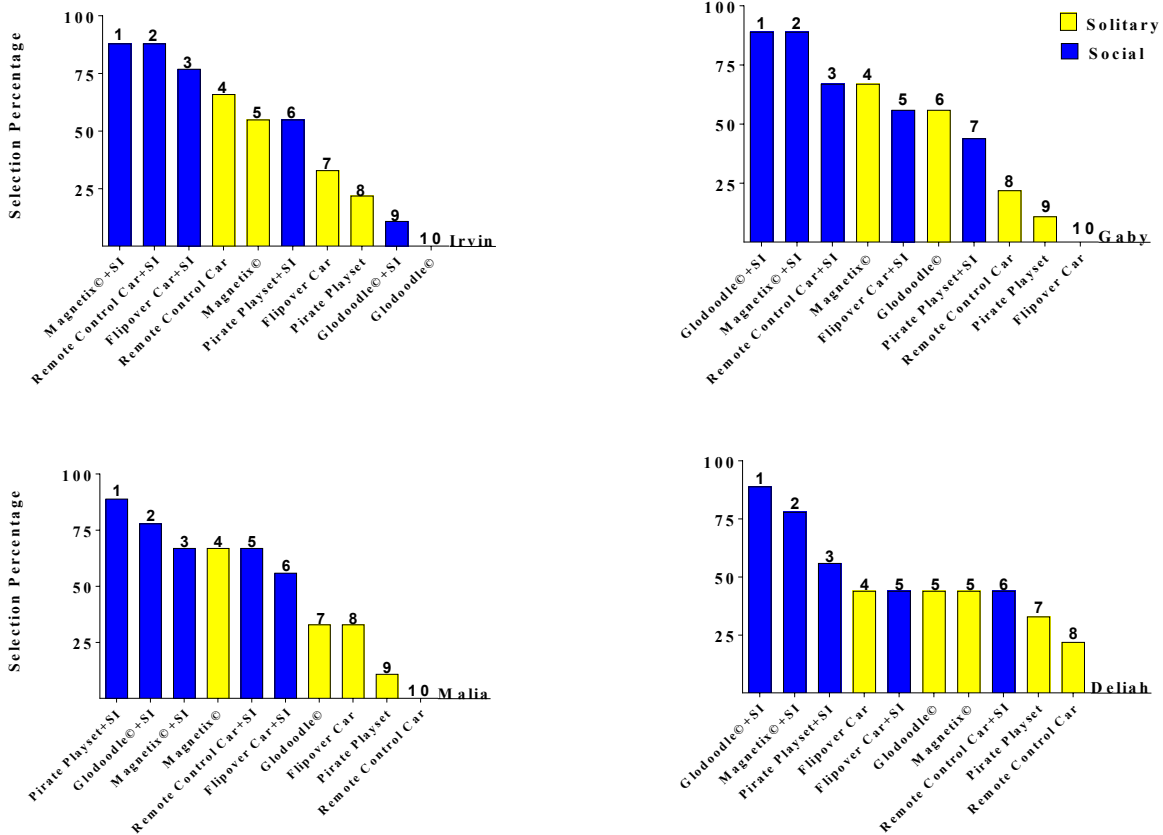


Figure 9. This figure depicts the Combined Assessment results for four participants (Irvin, Gaby, Malia, and Deliah) for whom three social stimuli were more preferred than all solitary stimuli. The numbers above each bar denote the calculated ranking of the stimulus.

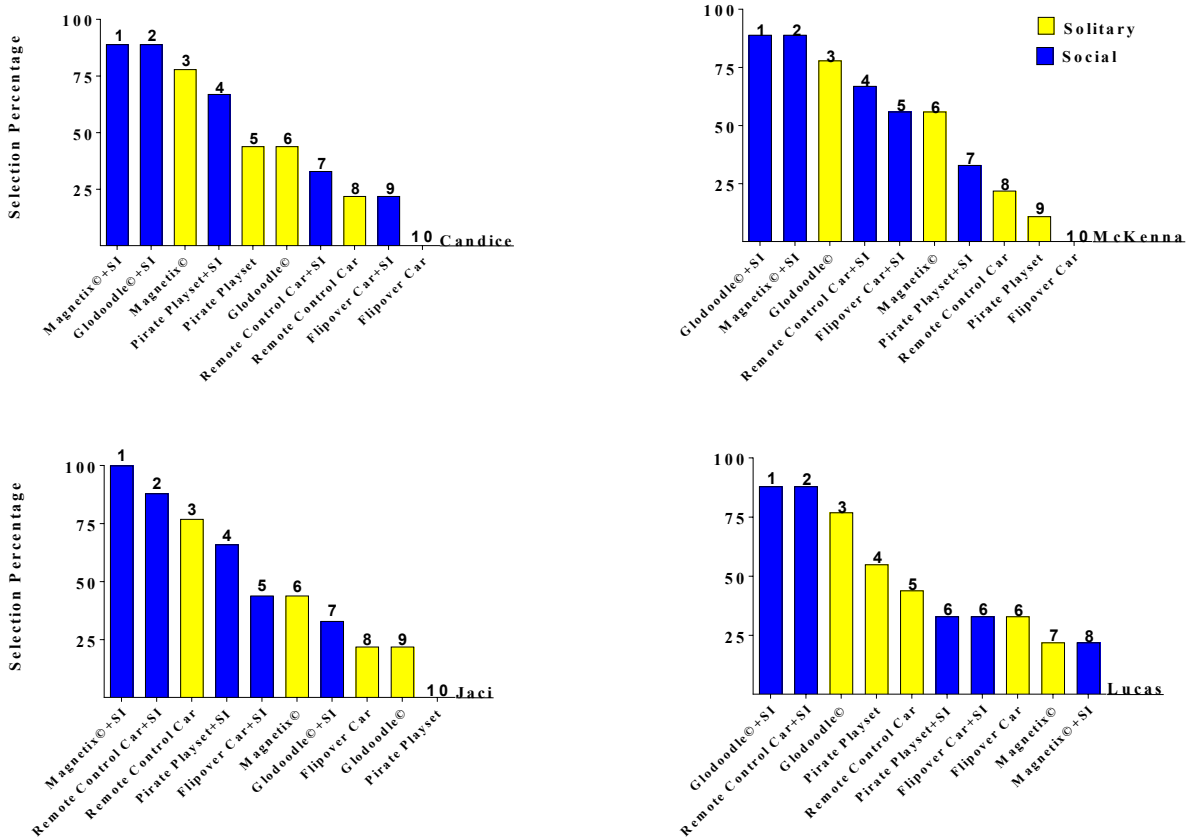


Figure 10. This figure depicts the Combined Assessment results for four participants (Candice, McKenna, Jaci, and Lucas) for whom two social stimuli were more preferred than all solitary stimuli. The numbers above each bar denote the calculated ranking of the stimulus.

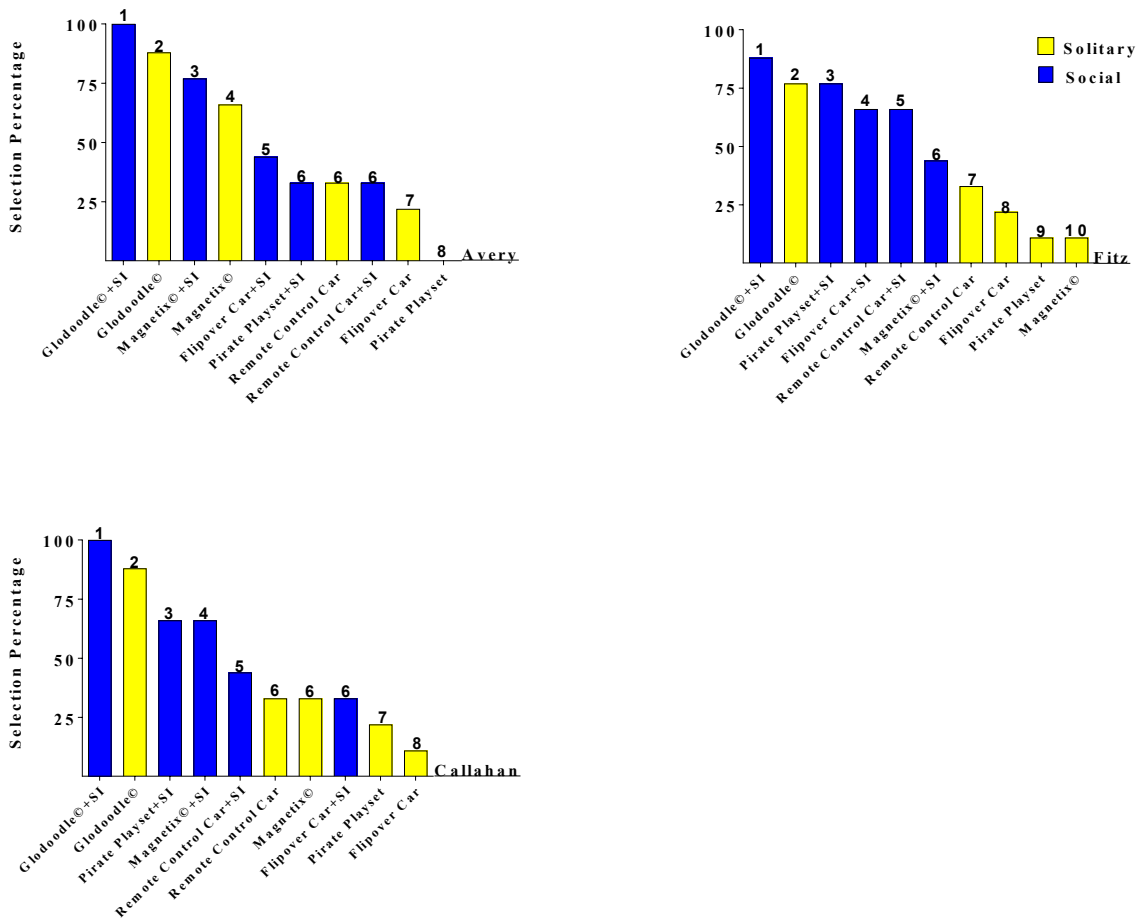


Figure 11. This figure depicts the Combined Assessment results for three participants (Avery, Fitz, and Callahan) for whom one social stimulus was ranked higher than all solitary stimuli. In addition, for these participants, their 1st and 2nd ranked item was the social and solitary stimulus that included the same toy, respectively. The numbers above each bar denote the calculated ranking of the stimulus.

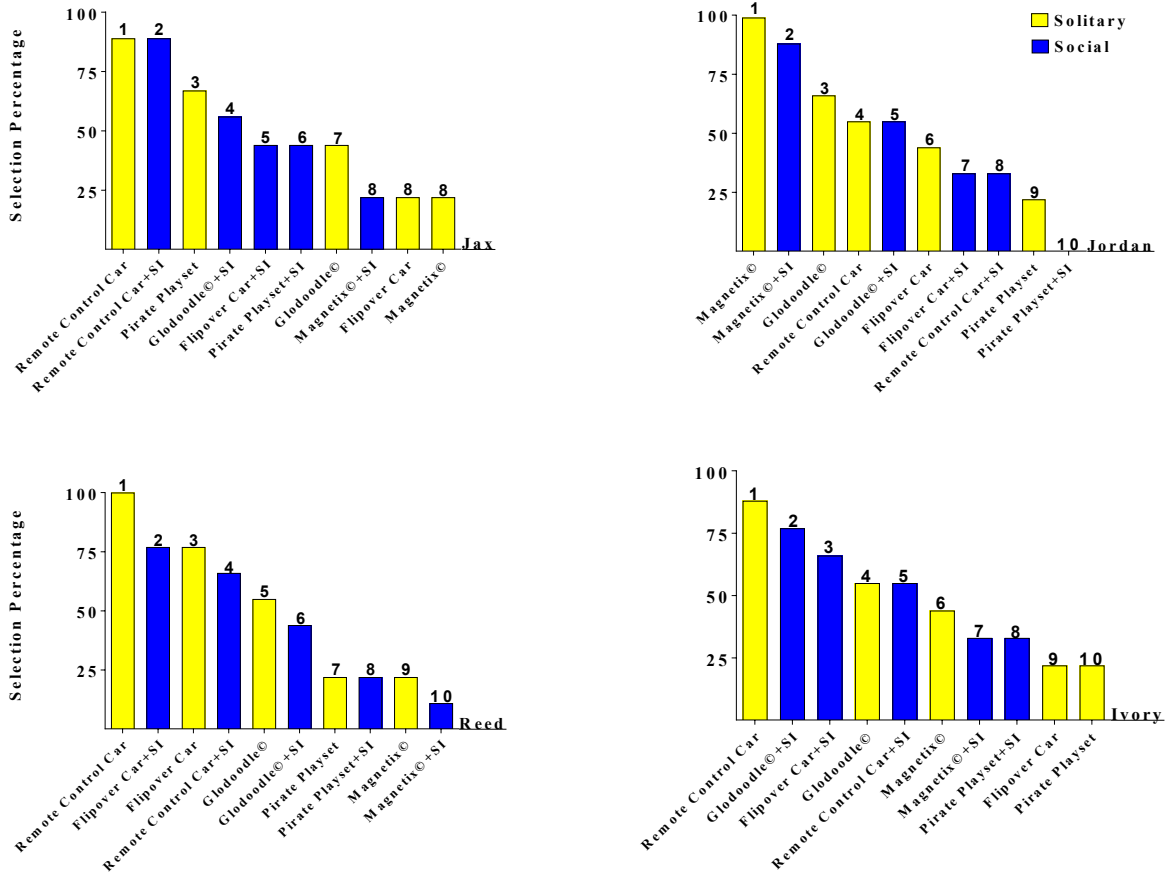


Figure 12. This figure depicts the Combined Assessment results for four participants (Jax, Jordan, Reed, and Ivory) for whom a solitary stimulus was ranked highest above all social stimuli. In addition, for two participants (Jax and Jordan), their 1st and 2nd ranked stimulus was the solitary stimulus and social stimulus that included the same toy, respectively. The numbers above each bar denote the calculated ranking of the stimulus.

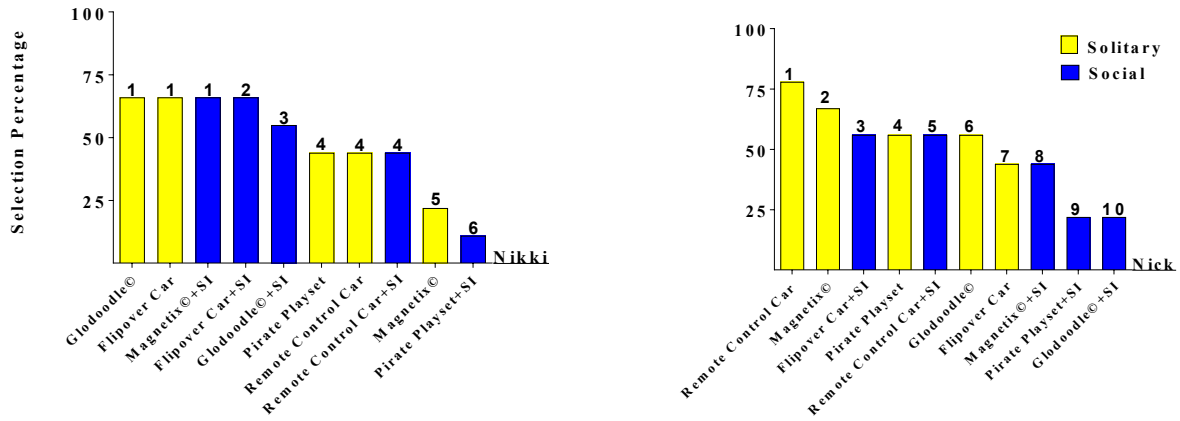


Figure 13. This figure depicts the Combined Assessment results for two participants (Nikki and Nick) for whom two solitary stimuli were more preferred than all social stimuli. The numbers above each bar denote the calculated ranking of the stimulus.

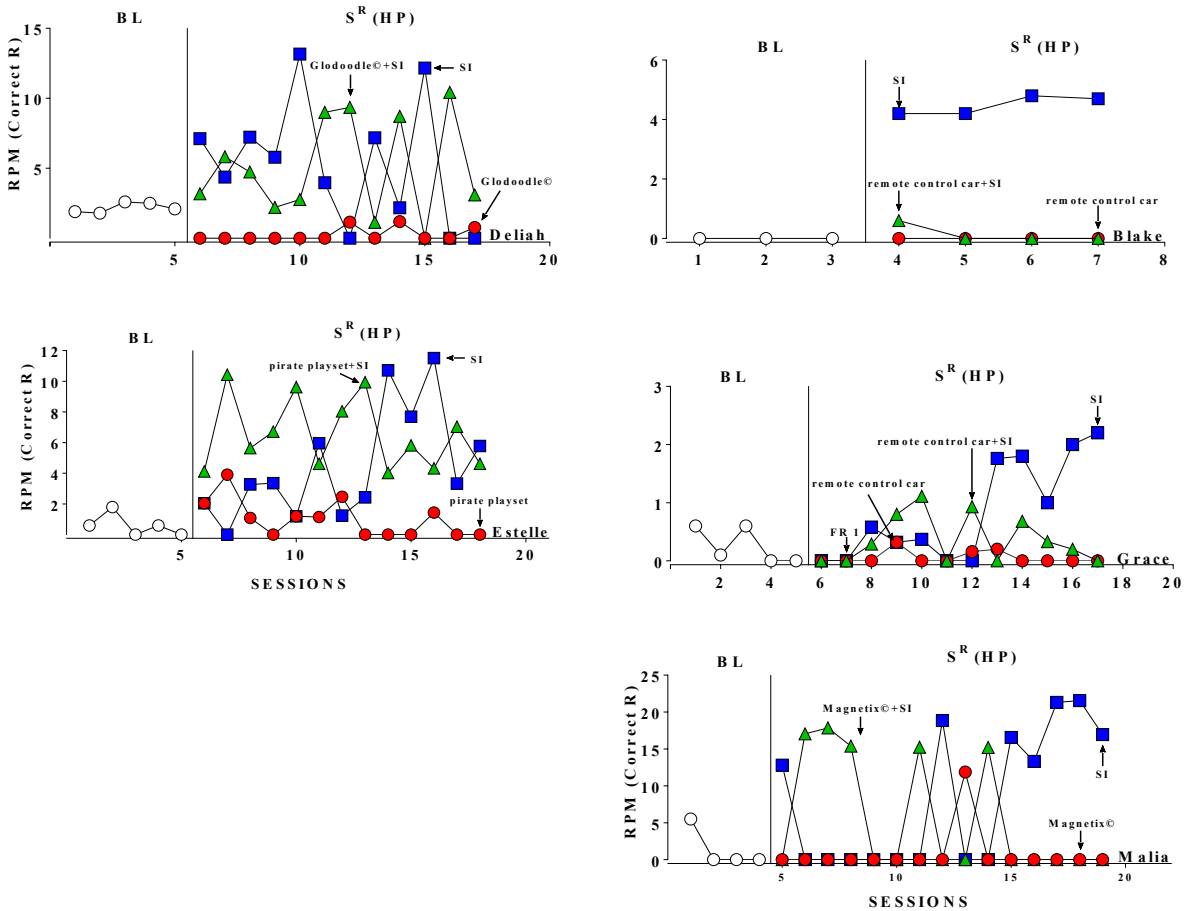


Figure 14. This figure depicts the reinforcer assessment results for five participants who were included in Study 3 because the majority of social stimuli displaced solitary stimuli in the Combined Assessment. In addition, these participants allocated more responding to either both SI alone and the social stimulus (toy + SI; Deliah and Estelle) or social interaction (SI) alone (Blake, Grace, and Malia).

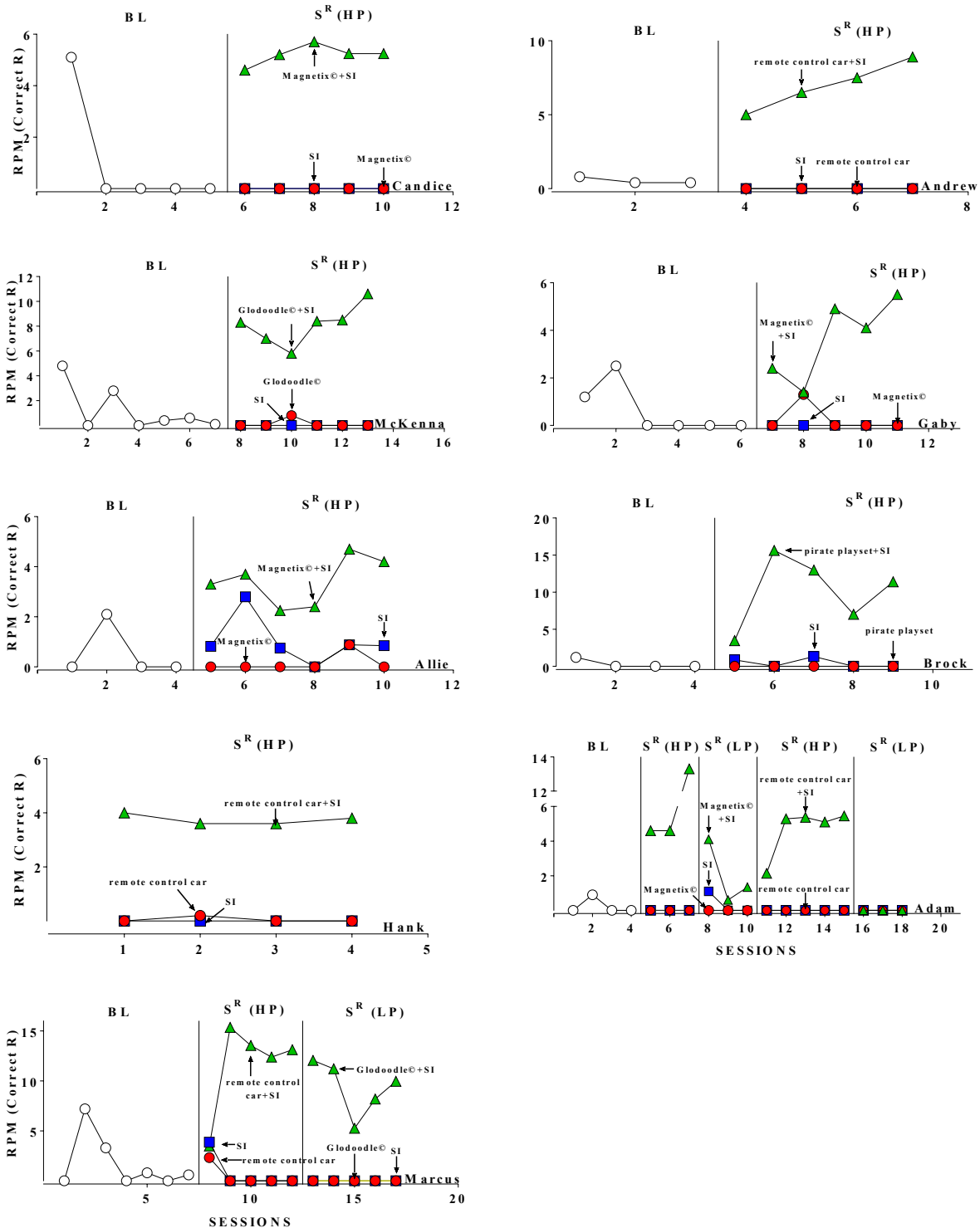


Figure 15. This figure depicts the reinforcer assessment results for nine participants (Candice, Andrew, McKenna, Gaby, Allie, Brock, Hank, Adam, and Marcus) who were included in Study 3 because the majority of social stimuli displaced solitary stimuli in the Combined Assessment. These participants allocated more responding to access the social stimulus (toy + SI) for both a high preferred toy (HP; all participants) and low preferred toy (LP; Adam and Marcus).

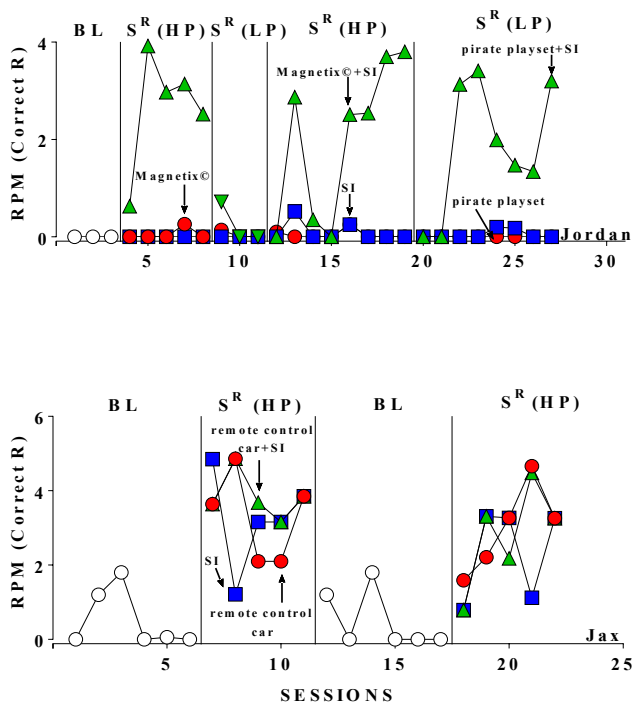


Figure 16. This figure depicts the reinforcer assessment results for two participants (Jordan and Jax) who were included in Study 3 because the same toy with and without social interaction was similarly high preferred in the Combined Assessment.

Appendix A



Appendix B



Appendix C

